BULLETIN
OF THE
AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXIV 1902. No. 3

MAPS AND MAP MAKING.*

BY

JOHN B. TORBERT.

The making of maps presupposes that information has been gathered with reference to that portion of the earth's surface to be pictured graphically. This accumulation of information usually goes through several great stages before the completed map, the object aimed at, is accomplished.

The first stage is that of discovery and exploration, when the character and apparent extent of the country are noted and observations, more or less crude, are made in an effort to fix the latitude and longitude (the position on the earth) of the country through which the explorer may be hastily passing. This phase, continued through the efforts of many men and usually covering a great number of years, during which time the country is opened up and industries started, gradually leads to the next step, or the Reconnaissance Survey of the region. This work is conducted with more care, and reconciles the many and often conflicting results of the early explorers. As the country is developed through increase of population and the consequent growth of trade and business enterprise, there is a demand for a more detailed map. As a result of this demand we eventually have a scientifically correct survey of the country on a convenient scale, which would form a reliable and suitable base for the still more detailed work for all other special purposes, such as railway building and public improvements.

The most conspicuous figures from among a host of other early philosophers, mathematicians, and geographers, each in his time

* Figs. 1, 2, 3 and 7 are taken from Appendix No. 15, U. S. Coast and Geodetic Survey.

standing as a milestone along the pathway of geographic knowledge and of map-making, may be named in the order in which they lived, together with the most important contribution of each to that knowledge.

Pythagoras, who flourished about 580 B. C., raised mathematics to the rank of a science, and devoted himself to the purely geometric phase of the subject. Herodotus lived about a century later. In his history, which included geography, he transmitted to posterity an account of the world as it was known in his day. Pytheas, who lived about 326 B. C., was the first to apply astronomy to geography. Dicaearchus, about 310 B. C., a pupil of Aristotle, made the first approach to a projection by dividing the then known world into a northern and a southern half by a straight line, thus drawing the first parallel of latitude. Hipparchus, who lived about 150 B. C., introduced among the Greeks the earlier Babylonian divisions of time and space, and of the circle into 360 degrees, with the subdivision of 60 minutes and 60 seconds and the corresponding divisions of the hour. He divided the equator and other great circles into 360 parts or degrees, and through these divisions he drew other circles, to which he was the first to give the technical name meridians. By thus employing two sets of reference lines, covering the surface of the earth with a network of parallels of latitude and meridians of longitude, he advanced the science of geography to a plane far in advance of his time, and laid the foundation for map-making for all time. It was he who pointed out, three centuries before the time of Ptolemy, that the only way to construct a really trustworthy map of the "inhabited world" would be by astronomically determining the latitude and longitude of all the principal points on its surface and laying them down in accordance with the positions thus obtained. As the materials for the construction of such a map were almost wholly wanting, and as the means of determining longitude could hardly be said to exist at that early time, the problems he proposed were allowed to slumber for nearly three centuries.

Crates, who lived about 150 B. C., made the first globe in representation of the earth, which maintained itself down into the Middle Ages. Marinus, who lived some time before Ptolemy, was the first to take up and give effect to the problems proposed by Hipparchus for the trustworthy representation of the countries of the world. Ptolemy, who flourished in Alexandria about 139 A.D., in common with all the early philosophers, mathematicians, and geographers from Pythagoras, as well as with the leading contemporaries of his

own time, held the doctrine of the rotundity of the earth, and had some idea of gravity. Availing himself of information acquired and imparted by the master minds of the world who had preceded him, he divided the circumference of the earth and other great circles into 360 parts or degrees, familiarized himself with the theory of projections devised by Hipparchus and others, and, incorporating the work of Marinus, he constructed a network of parallels and meridians, within which he placed the outlines of the world, so far as then known, with a wonderful degree of accuracy considering the resources at his command and the infancy of the science of geography at that time, and with a fair degree of accuracy for those early times determined the absolute distances eastward and westward. In spite of some great errors in his representation of areas, the scientific methods he pursued were perfectly correct, and he was the first to attempt to place the study of geography on a truly scientific basis. His principles and theories dominated the study of geography until gradually superseded and replaced by the progress and results of the maritime discoveries in the fifteenth and sixteenth centuries. As appears from the correspondence with Toscanelli, it was on Ptolemy's map that Columbus based his theories, and it may be truly said that we owe to Ptolemy the art of map-making.

The first requisite of and the fundamental principle underlying all stages of map-making is the determination of the location of the explorer, or the country to be mapped, with reference to the other countries of the earth; to fix its position on the earth with reference to latitude and longitude. Knowing, as we do at the present time, that the earth is, roughly speaking, a sphere that revolves on its axis once in every twenty-four hours, we at once have two points of reference from which we can measure—the ends of the axis of the earth, or the north and south poles. Midway between these two poles, describing the largest possible circle on the earth, we have a line popularly called the Equator, from which all measurements and references north and south are made. For convenience of reference, on either side of this central line at regular distances marking certain degrees of *angular divergence* from the equator, we have what are called parallels of latitude. To these imaginary lines on the surface of the earth can be referred any and every point. Being angular measurements, they have no special distance apart, as measured in miles, until the actual polar diameter of the earth is known. Knowing the size of polar circumference, mathematicians have calculated and reduced the length of a degree to miles. A

degree of latitude is a proportional fractional measurement of the north and south circumference of the earth. They are numbered by the degrees of *angular divergence* beginning at the equator, as zero, and, for convenience, numbering 90 degrees towards either pole.

The axis of the earth infinitely prolonged becomes the pole of the heavens, and where this extended pole is intercepted by a celestial body we have at once the requisite point from which to determine its altitude, or *angular divergence*, from any point on the earth. At the pole it is, of course, at right angles to the horizon, and at an altitude of 90 degrees. In travelling equator-ward in any direction the angle grows less, until at the equator it is on the horizon and has no altitude, so that on the great circle of the earth we have no latitude and must begin there with zero. The altitude, then, of the celestial pole, as measured by the *angular divergence* from the horizon, from any place on the earth's crust, is the latitude of that place. The Pole Star, while coming very near to intercepting the celestial pole, does not do so exactly, and for absolutely accurate results resort must be had to some other and more accurate method. The simplest method, and the one embodied with only slight modifications in all other determinations of this kind, is to measure the highest altitude of any prominent star above the horizon, and by deducting that altitude from 90 degrees you have its angular distance from a point exactly over your head. To this add or subtract, as the case may be, the declination of the star as found in the Nautical Almanac, and the result, after applying corrections for errors due to refraction and other causes, will be the true latitude.

By drawing lines through the 360 divisions or degrees into which the great circle and parallels of latitude have been divided, we have a second and most important system of reference lines, called meridians of longitude, which, together with the parallels of latitude, form a complete network within which to construct a trustworthy and accurate map of the world or any portion of it.

These lines, in common with the parallels of latitude, are not laid down (marked) upon the earth, but are imaginary, and being circular and of equal length, there is no means of determining one from another as a starting-point. This condition necessitates the fixing of an arbitrary zero, and up to only very recent years the principal nations established their respective chief cities as the zero from which was reckoned longitude east and west. England adopted the meridian of Greenwich; France that of Paris; Russia that of Pulkova; Germany that of Ferro, Canary Islands. In America the United States adopted that of Washington, and Mexico

that of its capital city. This multiplicity of zeroes of longitude resulted in so much confusion that the nations of the earth have in recent years come to recognize, and most of them have adopted, the meridian of Greenwich as the zero from which to reckon, east and west, all longitude.

The poles are the ends of the axis on which the earth makes a complete revolution once in every 24 hours. In rotating, every part of it comes opposite a heavenly body—the sun, the moon, or some one of the principal stars—once in each revolution. If an observer can ascertain certainly the *time* of a known star's transit across his meridian he knows his longitude; or if he knows the difference between its time of transit across his meridian and across that of any other station he knows their difference of longitude.

Latitude is the angular divergence north or south from the equator, and longitude is angular divergence measured by the *difference in time* in coming opposite a heavenly body. To observers situated at stations on the same *meridian* (differing in latitude) the heavens present different aspects at *all* moments. The portions of the heavens which become visible in a complete diurnal rotation are not the same, and stars which are visible to both observers describe different circles to their horizons and attain different altitudes. On the other hand, to observers situated on the same *parallel* (differing in longitude) the heavens present the same aspects only at different times. The visible stars describe equal circles to their horizons and attain the same altitude. In the former case a difference in locality is indicated by the appearance of the heavens, while in the latter case there is nothing in the appearance of the heavens to indicate any difference.

Through the recognition of its importance and the elimination of the international jealousies that formerly pervaded the subject, there has come to be recognized, by the leading nations of the world, not only one universal zero of longitude, but the custom as it has come to us from very early times of reckoning 180 degrees east and 180 degrees west of this zero has also become firmly established. As one complete revolution of the earth, of 360 degrees, is counted as twenty-four hours of time, one hour is then equal to 15 degrees, making degrees and their fractions equal to hours, minutes, and seconds in reckoning longitude.

Through the continuous accumulation of information and the gradual development of the subject a constant refinement of positions with reference to latitude and longitude has been going on and constitutes the information from which maps are constructed.

After sufficient information has been accumulated, the next thing in order is that it may be properly represented on a flat surface with the least possible distortion, so as to give the most satisfactory results for the purposes for which the map is to be used. This has been the aim and object of all map-making, and has engaged the attention of the leading mathematicians since the time of Ptolemy.

As the earth is a sphere, and its surface is curved, to spread out on a plane, without breaking or distorting, a spherical or curved surface is impossible, so that a perfect map is from the very nature of the case impossible to construct. In any effort in this direction there is distortion and disproportion of areas as a result. In their efforts to overcome these difficulties, to remove or minimize the effect of these errors, mathematicians and geographers from Ptolemy's time to the present have devised many forms of projection for the representation of the positions, shape, and configuration of portions of the earth, and each form may be said to fill its place in the map world. As the conditions differ for which particular projections are necessary, it frequently happens that different methods of treatment for the various cases become necessary, and for this reason no general theory underlying the whole subject of projections can be given.

In the absence of the possibility of a perfect map, the efforts of cartographers have been directed towards the production of maps in which all errors should be as nearly as possible eliminated, or such maps as would be best adapted for some special purpose.

In the development of the subject I hope to show clearly that if a map represents areas exactly, or free from distortion, or shows any line on the sphere at its proper angle with the meridians, one at least of the other objections, either in distortion or proportion, must be admitted. For navigating purposes, where angular accuracy is required, the necessities of the case must govern, admitting of no compromise with any other consideration. For general purposes, however, in the mapping of land surfaces in particular, the most suitable are those in which all the errors of distortion and disproportion are present, but by reducing both to a minimum a fairly good representation of portions of the earth's surface is obtained.

It is this projection or conventional representation of the curved surface of the earth with as little distortion and disproportion as possible on a flat surface that is the very foundation of map-making. In projecting a map regard must be had to the purpose for which the map is intended, as well as to the area it is to represent.

The errors in one form of projection being imperceptible in small areas or in areas near the equator would so distort and exaggerate large areas or more northern countries as to be fatal to its use. In the early days of geographic knowledge, when the general belief was that the earth was a flat disc surrounded by the sea, the maps that have come down to us plainly show in their construction the limited horizon of the peoples of the earth. As the range of vision widened through trade and travel, the horizon was extended, until eventually the true shape of the earth dawned on the minds of men and was reflected in the change that this knowledge made necessary in the mapping of the world. The Chaldaean shepherd, the Egyptian soothsayer, and the primeval priest, in common with the earlier Oriental astrologers, were probably first attracted by the celestial bodies as striking features of the cosmos. Later they were led through observation to note their rhythmic process with greater care, and cycles were established and eclipses and other phenomena were foretold long before the true structure of the solar system was introduced. Leading up from and through these early forerunners of the two great sciences of astronomy and geography, we come to a stage in their development where the accumulation of knowledge had extended the horizon far beyond the confines of the individual locality of the tribe or nation to the recognition of the vastness of the earth and the rotundity of its surface. Pythagoras, Hipparchus, Marinus, and Ptolemy stand out in bold relief as the pioneers who shaped the course of the advance of geographic knowledge and laid the foundations for map-making. From the early conception of the rotundity of the earth, through the different stages as represented progressively by these great minds, the representation of the earth began to assume new forms. In the final recognition of the earth as a sphere a new element forced its way into the construction of maps, until a clear understanding of the changes resulting in a continuous improvement in the method of correctly showing on a plane surface distances, direction, and configuration of any portion of the earth has been the result.

The name projection, as implied by the term, was derived from geometers, and was originally confined to representations obtained directly according to the laws of perspective. It has, however, through a long and gradual series of developments, come to signify any method of representation of the surface of the earth upon a plane. The ancients, in their attempts at representing the heavens and the areas of the earth's surface, were familiar with and employed

only the perspective forms which depended upon the supposed position of the spectator's eye, and on that of the plane of projection, and may be included under three heads.

The *orthographic* projection (Fig. 1) supposed the eye at an indefinite distance, and the plane of projection perpendicular to the line of sight, situated anywhere on that line. A map produced on this projection represents the areas at the edge as indefinitely small and very greatly distorted, and is well suited to maps of the moon.

FIG. 1.

Orthographic Projection on the Plane of a Meridian

The *stereographic* projection (Fig. 2) supposed the eye upon the surface of a sphere occupying the pole of a great circle, with the plane, which is that of the projection, bisecting this diameter at right angles.

The *gnomonic*, or central projection (Fig. 3), supposed the eye at the centre of the sphere and the plane of projection tangent to its surface.

In their application to astronomy and geography these forms are rarely if ever applied to small areas, but are usually confined to the representation of a hemisphere. It is only as we approach more modern times, however, after the subject has passed through and been worked over by the master minds of past ages, that we have reached the stage of map construction by so-called development. By substituting for the actual surface of the sphere a cylindric or conic surface, the great difficulty of the impossibility of representing the spherical surface on a plane is partially overcome by developing these forms in a plane. As a result of these methods we have projections developed along two different lines—those employing a cone tangent, generally at the middle parallel, and those employing a cylinder tangent, generally at the equator.

If a comparatively small region is to be projected, the operation will be rendered quite simple by substituting for the actual surface a cone passed tangent to the sphere along the parallel of latitude, which is at the middle of the region to be projected. By developing the cone (Fig. 4) upon a plane, the meridians will become right lines from the vertex of the cone to the different points of the parallel of tangency, and the parallels will be concentric circles, with the vertex of the cone as the common centre. Along the central parallel the areas will be equal to those on the sphere; but as the distance from the point of tangency increases, the distortion grows, and areas are shown larger than on the sphere.

FIG. 2.

Stereographic Projection on the Plane of a Meridian

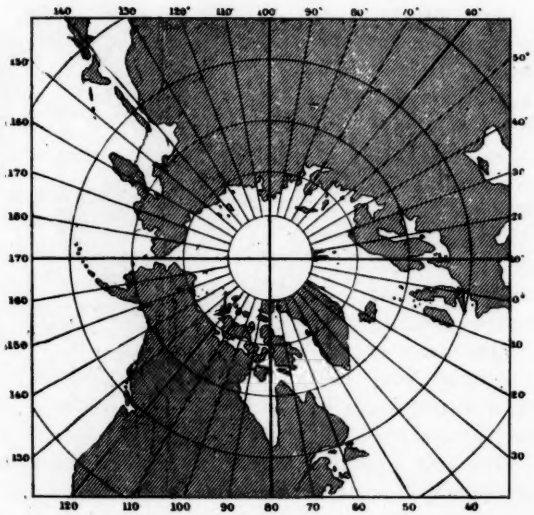
Mercator's projection (Fig. 5) is the one most used in the construction of sailing charts. It is also especially adapted for representing the earth as a whole and for mapping areas in the equatorial region. A cylinder tangent at the equator, with an axis coincident with that of the sphere, is cut by the meridians and parallels. The meridians will be represented upon the cylinder by right lines and the parallels by circles, the right sections of the cylinder. By developing the cylinder we obtain a projection in which both meridians and parallels are represented by right lines at right angles to each other. Between the meridians the distance is at all points the same, but the underlying principle on which this projection is based is that each element of latitude is increased in the same ratio as the longitude, producing an exaggeration in the areas, but no distortion. The Mercator's projection gives correctness of outline and of direction, and for nautical purposes, for which it was designed, is of the

greatest importance. A curved line, drawn upon the surface of a sphere in such a manner as to cut all the meridians at the same angle, is represented on the Mercator's projection as a straight line. (Figs. 4 and 5.) The meridians in Mercator's projection being parallel, a straight line would cut any number of them at the same angle; and as the longitude and latitude at every point are increased in the same proportion, the angle this straight line makes with the meridians is the angle the curved line makes with the meridians on the sphere. In navigation, by laying down a straight line between two ports, the

FIG. 3.

Gnomonic Projection

Plane tangent at the Pole

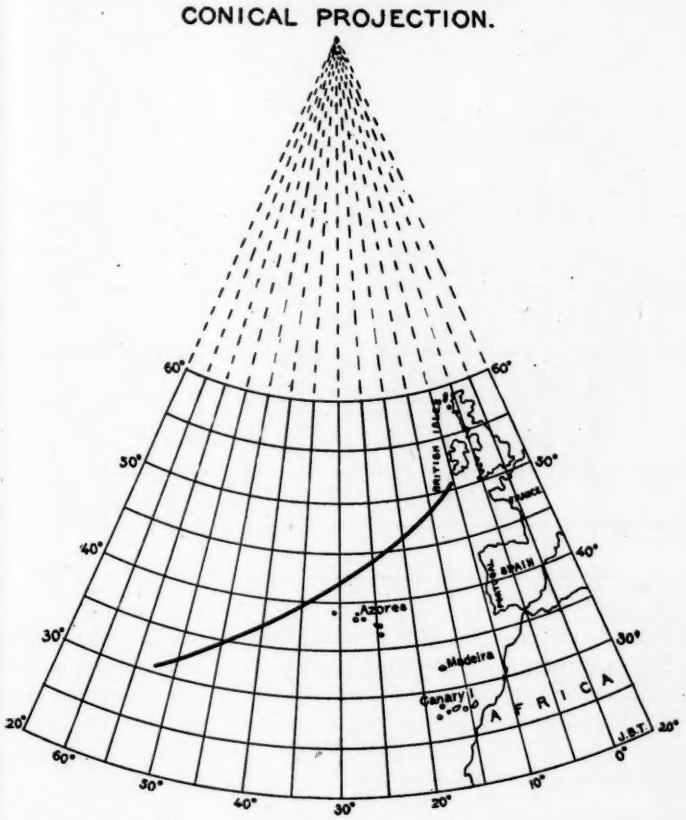


navigator is enabled to read all of his bearings on the maps. The want of uniformity of scale of distances is its great defect; but as it is of greater importance for a navigator to know his direction or course than to know his distance, this defect is overcome by the ease with which distances can be calculated.

By combining or varying the principles of these forms (Fig. 6) a great variety of this class of projection by development can be produced. The one leading to a reduction of the distortion, that is

always present in reducing from a spherical to a plane surface, is produced by substituting an intersecting for a tangent cone, in order that it may conform to the condition that areas of spherical zones should in their projection bear the same proportion as the corresponding areas on the sphere.

FIG. 4.



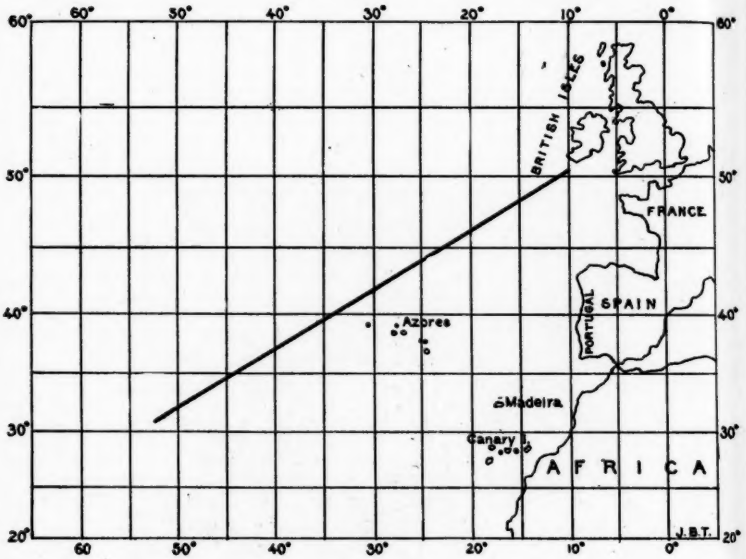
The polyconic, or that projection which is an assemblage of sections of surfaces of successive cones, tangent to or cutting a regular succession of parallels, and upon regularly changing central meridians (Fig. 7), may be said to have originated in conception with the

superintendent of the U. S. Coast Survey, F. R. Hassler, between 1816 and 1820.*

Supposing each parallel of latitude to be developed upon its own cone, the vertex of which is on the axis, at its intersection with the

FIG. 5.

MERCATOR'S PROJECTION.



tangent to the meridian at the parallel, instead of one tangent cone being used there is one for every parallel, and, theoretically, an infinite number. As each parallel of latitude is independently developed, the effect is of gradually increasing the length of the degree of latitude in proportion as we recede from the central meridian, upon which only they are correct.

* To show the difference between the Cylindric, the Conic, and the Polyconic projections:

The CYLINDRIC (Mercator's) is projected to the cylinder A, tangent at the Equator. The CONIC is projected to any one of the cones B, which are to be tangent at the middle latitude. The POLYCONIC is projected on the cones B,B,B, each tangent to successive parallels.

(Lieut. John E. Pillsbury, U. S. Naval Inst., Proceedings Vol. X.)

Through the similarity to the angles of intersection of meridians and parallels, which nowhere differ greatly from right angles, the

FIG. 6.

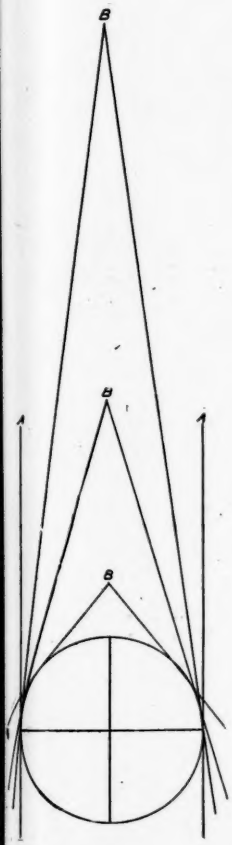
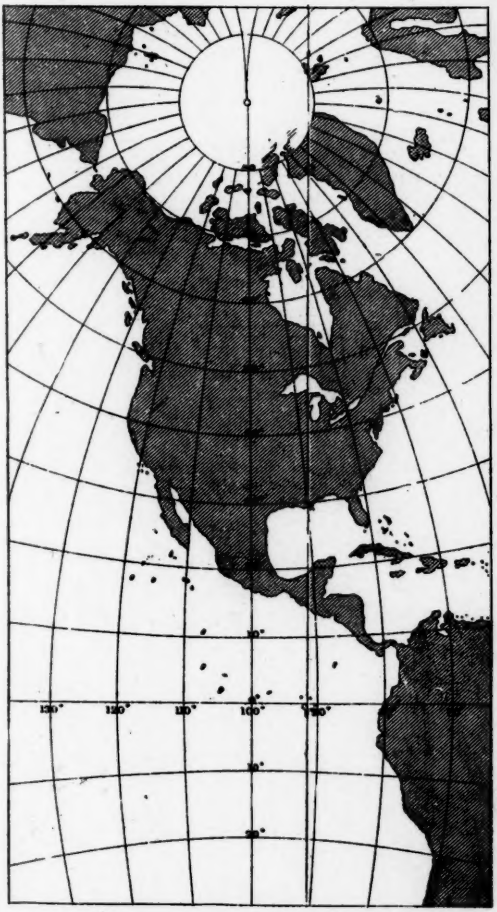


FIG. 7.

Polyconic Projection



figures on the sphere and the corresponding ones on the projection are very close. The parallels are divided into the same proportional parts as on the sphere, and are degrees, minutes, or seconds of lon-

gitude. While the exact proportion of corresponding areas on the sphere and the projection is not maintained, the same linear scale can be applied to all parts of a chart of limited extent, and distortion of areas is reduced to a minimum. The scale throughout is in exact proportion to the corresponding areas of the surface of the earth: a scale of $\frac{1}{63360}$ means that one inch of paper equals 63,360 inches of the earth's surface, or one mile of the earth's surface is equal to one inch on the paper.

The early pioneers of geographic knowledge laid the foundations of map making with such thoroughness that the superstructure, as we know it to-day, is built upon their work as a base. The information of configuration and relative positions and distances of the earth's surface, as it has been accumulated and systematized, has been developed on a plane surface, according to well-defined schemes of projection, that have gradually and successfully tended towards lessening the distortion and disproportion, until very satisfactory results have been obtained for the many different purposes for which maps are used. From a limited horizon and perspective projection of early times we have reached, in this day of enlightenment, a very comprehensive view of the earth as a sphere, and the representation of its surface in such wise as to produce the least possible distortion and disproportion of areas.

THE FOREST PEOPLE OF BRITISH GUIANA.

BY

JAMES RODWAY, F.L.S.

I.—The Boviander.

In journeying up the principal rivers of British Guiana a stranger is struck by the almost total absence of anything beyond the wall of vegetation on either hand. Hardly a habitation of any kind is to be seen for miles. If, however, he looks closely at the banks he will see here and there under the bushes a canoe or bateau, and if he goes closer will find a small opening. Here, if the water is low, will be seen a cylindrical log lying on the mud; this is the landing-stage of the boviander, one of the people living "above yonder," away from the coast and its population. If he can get ashore by means of such a slippery wharf he will find a narrow muddy path, at the termination of which is a tiny hut thatched with palm leaves.

The bovianders are of all shades. Whites, Indians, negroes, and even Chinese are to be found among them, but by far the majority are mixed in such a way that there are no names to distinguish them. Some are descended from connections of Dutch planters and Indian or negro slaves, others from the offspring of Africans and Indians, a few, no doubt, from bush negroes. Nominally they are timber-cutters, charcoal-burners, and provision-growers, but they only work when in the humour, and that is not very often. As, however, their wants are few they manage to live after a fashion.

Under the influence of their surroundings they have become silent and reserved, like the Indians, and, like them, are at home on the river or in the forest, rather than in towns and villages. Even when they are to all appearance pure negroes they have less of that noisy, boisterous manner so conspicuous elsewhere. Taken altogether they are agreeable, and quite hospitably inclined, as far as their means allow. As in the case of the Indian's home, you may make yourself quite free with the hut of the boviander. You are welcome to everything he has, which is generally nothing that you are likely to want.

My first trip up the Demerara river was taken in company with an old man, who might have been a mulatto, judging by the colour

of his skin. His crisp, grizzled hair was drawn up from his forehead to form an elevation; possibly "the cockatoo fashion" that prevailed in the early years of the century.

He called for me a little after midnight, and with the quiet remark, "Water wash a'ready, sir," prepared to carry my baggage to the stelling (wharf). Arrived there I saw a small bateau lying on the mud with its farthest end washed by the rising tide. It did not take long to stow ourselves and the impedimenta; then, with a push of the paddle, we floated into the open river.

The moon was overhead, throwing its pale light on the harbour and shipping, and as we floated lazily past the wharves I thought of the name Rio De Mirara, found on some old maps. It was strange to me; perhaps it might be wonderful. Once its banks were lined with plantations for nearly a hundred miles. The stolid Hollander, the enterprising Scotchman, the Huguenot refugee, and possibly some descendants of transported Jacobites from Barbados, superintended the clearing of the virgin forest by their slaves. They erected horse and water mills to grind their canes, drove their negroes into the field with the whip, and were as rough a set as are pioneers in any new country.

Now nature has resumed her rights, only opposed by a few weak boviander. The dark line of bush we were passing was not virgin forest, for it had lost its best timber trees, but it was none the less dense on that account. Even in the moonlight I could see clumps of bamboos, the original stock of which was brought from the East Indies two centuries ago.

Vainly I attempted to distinguish the trees as we passed. Near the shore the hum of insect life was quite loud; farther out in the river it was subdued or lost altogether. Now and again came a whiff of what I afterwards well knew to be the reek of the forest, reminding me of the Kew palm house in winter. Then came the perfume of some night bloomer, whether near or far it was impossible to say.

Slowly we floated along, my "Captain" only steering the craft. Once or twice I tried to learn something from him of the plants and animals of the forest, but he could tell me little beyond what I knew already. Now I would doze off for a few minutes and wake to wonder where I was. But whether we were passing "Golden Grove," "Garden of Eden," or "Land of Canaan" the same dark line of forest met my eyes. Off Borsselen Island I thought of the time when the Demerara public offices stood here, and of the fear of pirates which led the early settlers to go so far inland. It was

here that in 1781, when Georgetown was unthought of, the Honourables met to consider the advent of some Bristol privateers and the answer that should be given to their demands. Now the island was covered with jungle, and the tombs of the Councillors are mostly lost in the second-growth forest.

As dawn appeared the birds awoke. From a silk-cotton tree, decked with hanging nests, came a flock of bunyas, and here and there a toucan's puppy-like bark could be heard. Then there were sounds that I did not recognize, mingled with one quite familiar—Cock-a-doodle-doo! Yes, behind this thicket were boviander huts, and the domestic cock greeted the morn like the others.

Now a few signs of human life began to appear. From the different landings came the bovianders in their craft—punts worked slowly with long sweeps by two men, bateaus of all sizes, and dug-out canoes. Every one had a hearty "Good morning" for my "Captain," and remarks were freely passed as to the destination of the buccra. Here would be a little boy or girl in a great clumsy bateau, and there almost a baby sweeping a craft more fitted to its size. But whether little or big—man or child—all were quite at home on the water. Perhaps the little one could have no breakfast until she had gone to the shop three or four miles away to spend the penny or twopence just given her by father. Poor children! I was inclined to pity them until I heard their "Good morning, sah," and saw how happy they appeared. No matter that they had hardly enough clothes to cover their nakedness, and that they often passed the whole day without a meal, they were still merry.

As the sun appeared above the forest my "Captain" steered the bateau into a little opening, and I saw before me a chained log for a landing-stage. With the assistance of a paddle I managed to get ashore to meet a welcome from Miss Boviander and her mother.

Before me was a muddy footpath lined with long grasses and weeds, dripping with the heavy dew, terminating in the usual troolie* hut. Looking round I saw that there was a fair number of fruit trees, such as oranges, lemons, starapples, and breadfruit, but all were so choked by weeds and scrambling vines that only one or two were bearing. However, I was interested even in the weeds, for they differed from those of the coast lands.

My baggage was soon brought into the hut, and I sat down on the only piece of furniture—a kerosene box—until my hammock was slung. Consisting of six upright sticks to support the troolie

* Palm-leaf.

thatch, this boviander home was divided into two rooms—quite a luxury as compared with the open benab or shed. But, unfortunately, while the Indian's hut is usually spacious and open, that of the boviander is low, with thatched sides and partitions, except in front. Again, the Indian generally secures an elevation for his settlement; the other chooses the low ground on the banks of the rivers.

However, I had provided myself with quinine and chlorodyne, and troubled very little about the position. The novelty alone excited me, and when I had eaten a good breakfast—from my own trunk, of course—I felt quite comfortable. Still, I could do little that day beyond botanising round the hut; after that I slung my hammock between two trees and made up for last night's vigil by a refreshing sleep.

In the afternoon some neighbours came in bateaus, and after a little talk with them I went to see the notables of the village. There was actually a shop some half a mile away, kept by a Chinaman, who invited me to take a cup of tea! This I rather enjoyed, although it was cold and without the usual accessories. Then I visited the parson or catechist, who, no doubt, thought himself somebody. Perhaps the most important after all was the boat-builder, for his trade is the only one of any importance on the river. Everything save the bateau can be procured easily enough, and the river man must have a craft of some sort, which, as a rule, he cannot make himself.

Coming back to my lodging, I had a little time to look round. Mrs. Boviander was apparently of Indian descent, with traces of white and negro blood. She seemed to be always standing over the fire, cooking something or other, and very rarely spoke. Her daughter, however, was quite lively, and always ready to do anything that lay in her power for the stranger. There was a naked baby sometimes crawling upon the earthen floor or, when asleep, stowed away in a box. At first I wondered who were his parents, but this was soon settled by my host's daughter suckling him in my presence.

The young mother was darker than either of her parents, and might be taken for a cob (the offspring of a mulatto and a negro), but the baby looked to be almost pure Indian. No doubt the general desire for fair children, so common among negroes, was responsible for this brown lump of humanity. Of course, Miss Boviander was not married; nor do I suppose that half the people along the banks of the river have ever gone through the ceremony.

Towards afternoon a young fellow, whom my host introduced as his son, came in with his Indian wife. They lived up the creek, and appeared very glad to see the stranger, for whom they brought a joint of labba* meat. Mrs. Boviander, Junior, wore a plain print frock like a loose dressing-gown; probably this was her whole dress, judging by the way it hung.

As night fell I brought out my candles, and we sat in our hammocks for a cosy chat. The old man was a little more talkative than he had been the previous night, and I learnt something of his inner feelings. Of course, he was shy and hard to draw out; but as I pressed one question after another his reserve broke down.

It was interesting to note how the superstitions of Africa and America had been blended with those of Europe. There was the mermaid or water-mamma, who lived in a deep place up the creek, and drew under water all who ventured to bathe near her habitation. Possibly the siren of the ancients had been confounded with the manatee, and this again with some Congo deity. Then he told some "Nancy stories," reminding me of "Brer' Rabbit." Anansy was a great demon spider, possibly suggested by the great hairy creatures of the tropics, and all his tricks were attempts at overreaching other animals and man. It is noticeable that half-civilized races, like the negroes, always admire smartness entirely apart from its morality. A clever ruse by which a rogue escapes from his deserts is thoroughly enjoyed by them, and I have seen a little crowd clap their hands and cheer at seeing a rogue get away from a policeman.

Mr. Boviander's interest in the forest consisted mainly in timber trees, and especially greenheart, mora, and wallaba. There were very few of the two first in the neighbourhood; they had all been cut down long ago, unless they were old and decayed or too young. He remembered when timber-cutting paid well; now the good times were gone. It was the old story—the best time, even here in the Guiana forest, is long past.

He could not hunt, for he had no dog. Good hunting dogs were very scarce, and even here the Government license stood in the way of raising them. And then the training was hard work; only Indians could do it properly. Not every dog could be made suitable for deer or labba, and if he were to pay for several until he found one to suit it would be very hard.

In reply to my questions as to wild beasts, he said there was now and then a tiger (jaguar), and plenty of snakes. Few people,

* A kind of guinea-pig.

however, were bitten by snakes, but they were very destructive to domestic fowls. There were no vampire bats near by, but farther up the river you could hardly sleep in the open without the risk of their sucking your feet.

The dangers of the forests consisted—to him—rather in the unknown creatures than in those familiar. There was the Didi and the Akreo, two types of the wild man of the woods. If you came across one of these, you must not look at him, or something very bad would happen. He had once seen the Didi peeping through the fork of a tree, and ran away as fast as he could. Perhaps it was a baboon or howling monkey, the nondescript of Charles Waterton, but my host would not admit such an idea. He had shot and eaten baboons often enough; to suppose that he did not know one of them was almost an insult.

But beyond everything else in the bush, the most fearful is the Kenaima. He was related to the Indians himself, but those were Arawaks—the Kenaimas were Acawoios. A boviander friend, living far up the river, once wronged one of these people, with the result that the avenger of blood came upon his track as a tiger Kenaima. His body blotched like that of the jaguar, he followed the man from place to place until the opportunity for vengeance occurred. The boviander stole a light canoe and hurried down the river, hardly giving himself time to sleep. He was so exhausted, however, on reaching this house that he came in and begged my host to hide him for a few hours. Terribly frightened as he was, Mr. Boviander could not refuse, but he was much relieved when his friend left. A few hours later he was horrified to see a pair of eyes staring from the bush, but soon finding that his prey had escaped, the avenger went on to Georgetown.

The refugee could do little in Georgetown, and, as he had no friends, was soon almost starving. For some petty theft he was sent to jail for a month, and was thus safe for that time. But the Kenaima remained in the neighbourhood, living somehow or other, until his victim was released, and could get a passage to Essequibo with some woodcutters. Several months passed, during which the boviander dared not remain alone for a minute, for he knew that there could be no chance of his escape if the Indian once got hold of him. At last the opportunity arrived, the human tiger sprung upon his victim, the heavy club broke his skull, and all was over!

(*To be continued.*)

THE RUINED PUEBLO IN NEW MEXICO DISCOVERED BY VARGAS IN 1692.

BY

J. WALTER FEWKES.

On the return from his first entry into New Mexico in 1692, Vargas followed a new trail from Inscription Rock to Socorro, passing through a section of the Southwest, of which nothing was known by the Spaniards up to that time. It may be added that in the two centuries which have elapsed little has been added to our knowledge of the archæology of this region, which in that respect practically remains to-day a *terra incognita*.

Two mountain ranges are mentioned in the itinerary of the return trip of Vargas, viz.: the Ladrone and the Magdalena, which are still designated on modern maps of New Mexico by the same names. Why the name Ladrone, or Robber Mountains, was given to the former of these sierras is a question foreign to the purport of this article, but the application of the name Magdalena to the latter may have a bearing on considerations which follow. It is possible that this name was first applied to them on account of a natural configuration on the face of the cliffs resembling the head of a woman, and that Vargas, recognizing this resemblance, first applied to it the name Magdalena. This natural head on the mountain side can still be distinctly seen.

In the itinerary of Vargas' return trip mention is made of a "ruined pueblo" in the Magdalena Mountains. The site of this ruin has not been definitely made out by archæologists, and, save the brief mention of it in Vargas, nothing is known of its size, general characteristics, or the kinship of its former inhabitants. The object of this article is to shed light on this obscure subject.

There is every reason to believe that in his route from El Morro, or Inscription Rock, to Socorro, Vargas passed near several ruined pueblos, but only one of these so impressed the narrator of the expedition that it was especially mentioned. The stone face in the mountain makes it an easy task to explain the name still used for these or neighbouring sierras, and to fix upon a limited area for investigation into the probable site of this ruined pueblo. Believing that from available data it would be possible to identify this ruin, the author visited the town of Magdalena, New Mexico, in the

autumn of 1901, and made an examination of the neighbouring territory with this thought in mind.

If Vargas used the trail which passes northeast of the town Magdalena, and to the east of the Gallinas, he probably camped at a spring now called Ojo del Pueblo, about a mile from the present settlement Magdalena. Near this spring there is a ruin, which is designated on old maps *Pueblo*—a name which it has borne from remote times. Not far from this spring is an old tavern and corral, at which early travellers along the route remained overnight before Magdalena was built. All the historical evidences examined led the author to suspect that *Pueblo* is the Vargas ruin; but before definitely stating his conclusion he will present the results of his personal examinations of other ruins in the neighbourhood.

While exploring along the foothills of the Magdalena Mountains he encountered many traces of former habitations, but found no pueblo ruins of any considerable size. There is a fortified hilltop not far from the mining camp Kelly—a town much older than Magdalena; but the author found no ruins there, although some of the best maps put *Pueblo* near the older settlement.

The author examined, all told, four ruins in the neighbourhood of Magdalena, and has no hesitation in concluding that the Vargas pueblo was not in the mountains but in the foothills of the same. He likewise continued his studies into the Gallinas, fifteen miles north and west, where there are many ruins, only a few of which, but enough to determine the type, were examined.

In order to obtain an idea of the general character of ruins in the neighbourhood known to have been inhabited by the Piros stock, a few excursions were made in their ancient ranges about Socorro, New Mexico. One of the best of the old Piros ruins near this town is situated about four miles north, on a hill overlooking the right bank of the Rio Grande. It is a very small ruin, presenting little of interest aside from a circular depression identified as a kiva. The position of the former house walls is obscurely indicated by rows of stones; but the mounds of débris are low, with only a few fragments of pottery on their surface. Other Piros ruins, as those at the Socorro Hot Springs, and those three or four miles down the river, are poorly preserved, presenting little above ground to study.

As all the ruins near the Magdalena Mountains save one failed to satisfy the conditions of Vargas' "Itinerary," and as that locally called PUEBLO presents the strongest facts in its favour, a considera-

tion of its general character may well occupy our attention before passing to the others.

Pueblo is situated on a slight elevation to the right of the arroyo, not far from Ojo del Pueblo, about a mile and a half from Magdalena. Its present condition shows that it was formerly a place of many inhabitants and covered an area about 300 feet square. Its general shape is rectangular, formed of a number of rectangular house clusters enclosing a plaza in which are two circular depressions, which may be identified as kivas. The component dwelling-house clusters are six in number, large and small, with walls formerly built of stone but now worn down or fallen, forming mounds, over which the tops of former walls are traced with some difficulty. None of the old walls now rise above the surface to any considerable height.

The indications are that each of these component houses was composed of many rooms, arranged in parallel rows; but no data were gathered to prove whether or not the buildings were higher than a single story. The highest rooms overlooked the arroyo and the lowest were situated on the north side. Two circular depressions in the plaza or space enclosed by the component houses mark the positions of the kivas, which were apparently semi-subterranean. The larger measured about 20 paces in diameter, and was situated wholly within the plaza, while the smaller, about 12 paces in diameter, almost fills an interval between the foundations of two house clusters, leaving narrow passageways on each side.

A section of the wall of the larger kiva has been exposed, and shows well-laid masonry set in adobe plaster. The configuration and altitude of the wall indicate that part of the kiva was above ground. The dumps or ash-heaps of the pueblo were apparently just outside the village on the north side. By scratching in this deposit many fragments of pottery, some of which were red, others black and white, or black and glazed, were found. A small fragment of yellow ware, which reminded the author of the type common in Tusayan, was found not far below the surface of the ground. This specimen was painted and decorated with incised figures.

While Pueblo is the largest ruin near the settlement Magdalena, it is not the only one in this vicinity. There are at least three others to be considered, one of which is above the same trail as Pueblo, a mile and a half beyond it, or about three miles from Magdalena.

This ruin is situated on the summit of a low hill covered with piñon trees, and is small, composed of a few houses and destitute

of a kiva. It bears all appearance of having been a place of refuge rather than one of permanent habitation.

Two other ruins, situated respectively four and five miles north of Magdalena, were examined by the author. Neither of these is on the trail from Socorro to Inscription Rock; nor do they answer the conditions which would lead to the belief that either was the Vargas ruin, although the size of one is as large as that of Pueblo.

This ruin is situated five miles north of Magdalena, and is approached by the road which passes the cemetery of this town. While in general it resembles Pueblo, its form and arrangement of house clusters are somewhat different. The rooms are found in a dilapidated condition on three sides of a rectangular court or plaza, the east side being vacant, the surface of the ground sloping from the court on that side to a broad plain extending to the distant mountains. High hills surround the ruin on the remaining sides, but its site is not elevated from the adjacent level.

This ruin has a marked similarity to Pueblo and those north and west of Socorro. There is a single circular kiva near the west end of the plaza, and several extramural circular depressions, which perhaps mark sites of kivas or reservoirs, on the west side. The arrangement of these rooms, no less than that of the walls of the ruin itself, recalls ancient habitations on the Tularosa, in Western New Mexico. One marked difference, however, is the absence in the Tularosa ruins, as described by Mr. U. Francis Duff*, of kivas in the central court or plaza, although in both localities these rooms have circular forms.

Circular kivas are confined to definite areas in the Southwestern ruins. These are, as a rule, confined to the zone from the cliff-houses of the Mesa Verde, in Southwestern Colorado, to the central and southern parts of New Mexico, while the kivas of Arizona ruins are almost without exception rectangular. There are, of course, many kivas, ancient and modern, in New Mexico which are rectangular, and a few in eastern Arizona which are circular, but the generalization is true notwithstanding these variations. The circular rooms in the ruins near Socorro, Magdalena, and the Tularosa are the most southern examples of this form yet recorded in New Mexico. Whatever may be the explanation of the circular form of kivas, the cause must be considered in the light of the distribution of the form and its limitation.

The character of the pottery from the ruins about Magdalena

* *Bull. Amer. Geog. Soc.*, Vol. XXIX, No. 3.

resembles that of the Tularosa; but the number of objects is much less, not a single whole specimen from the former being known to collectors.

There is a small ruin near the road to the larger above mentioned, about four miles north of Magdalena. This ruin is a small one, situated in a grove of dwarf pines and cedars growing in sand hills. Its form is rectangular, and the walls are of stone, but no kivas were seen. The pueblo was evidently a temporary habitation, and the spring formerly used was either buried or gave out, for the nearest water is now at a considerable distance from the building.

The large ruins in the Gallinas, north and northwest of Magdalena, although not far in a direct line from the trail Vargas may have taken, do not appear to have attracted his attention, and were probably not inhabited at the close of the 17th century. Their present size indicates a considerable population in ancient times, and their numbers point in the same direction.

The largest of the Gallinas ruins is one of the most extensive the author has seen in the Southwest, consisting of two large sections separated by an arroyo. The ruin lies not far from the Gallinas Spring, where there is a ranch and corral, and a continual supply of potable water.

From the distribution of the mounds it appears that the general shape of this pueblo was rectangular and pyramidal, destitute, however, of a central court. The section on the right bank of the arroyo is larger than the other, and its walls are more broken. While it is difficult to make out definitely the real outlines of this section, the indications are that just above the bank of the arroyo there was a level space, which, no doubt, once served as a dance place, and near it, farther removed from the arroyo, a confused mass of mounds indicates the sites of the former houses closely united together. At one point a deep trench has been dug into one of these mounds, revealing house walls and a paved floor over fifteen feet below the surface. No circular depression indicating a kiva was noticed, and the mounds were examined with this especial feature characteristic of Magdalena ruins in mind.

The mounds of the same ruin on the left bank of the arroyo take the form of two parallel rows of rooms overlooking the dry watercourse. There are evidences that in some places the walls of these rooms were two or more stories high. Here also kivas were missing.

There is a stone ruin of considerable size near the ranch at Council Rock, in the Gallinas, about 12 miles from Magdalena. It

is a confused mass of fallen walls, indicating a pueblo of considerable size, but no walls now stand above the surface of the mounds. The fine trees in this and other parts of the Gallinas make attractive camping-places, adding much to the beauty of the scenery.

Almost everywhere one turns in this region there are ruins, large and small. A few miles from the Gallinas Spring, down the wash from it on the left bank of the arroyo, there is a small rectangular ruin called by the cowboys the Juan Ranch ruin. It is a rectangular ruin, with central plaza containing remains of houses, but no circular kivas. The walls of the houses can be traced without difficulty, and the dwellings were apparently one story high. No ash heaps or piles of débris were noticed about the fallen walls, and the indications imply that this pueblo was inhabited only a few years.

The examination of the ruins visited in the search for Vargas' pueblo, in the Magdalena Mountains, revealed many localities which would well repay systematic excavations and extended study. An accurate investigation of these ruins would undoubtedly shed a flood of light on our knowledge of ancient pueblo life in Central and Southern New Mexico.

The result of the author's search for Vargas' ruined pueblo, in the Magdalena Mountains, indicates that it is the ruin now called PUEBLO, not far from the modern settlement Magdalena. He believes that the ground plan of this ruin and other surface indications, especially the circular depressions called kivas, imply that it was inhabited by the same stock of Indians, or closely-allied people to the Piros, who once lived in the neighbourhood of Socorro. The data gathered concerning the ruins in the Gallinas are not complete enough to answer the questions of the kinship of their inhabitants, but, so far as they go, would imply a relationship to the group of pueblos called Tiwa. The modern survivors of this stock still live in Sandia and Isleta, New Mexico, and are also represented in the town Ysleta, in Texas, not far from El Paso. The Piros Indians have long ago disappeared from their old range near Socorro, but a few families still remain in a hamlet in Chihuahua, near the city Juarez, on the right bank of the Rio Grande.

NOTES ON THE FLORA OF THE WEST INDIES:

With Special Reference to the Island of St. Kitts.

BY

W. H. ALEXANDER.

West Indian Flora.—Many of the staple vegetable products of the West Indies have been introduced from other parts of the world. This is also true of most of the vegetables grown for food, of a number of the fruit trees, of the garden flowers and foliage plants, and of some of the grasses.

The genial nature of the climate of the Antilles and the fertility of the soil have enabled these exotics to grow as in their native countries. The facility of cultivation encouraged the settlers and their descendants to stock the West Indies with plants from every quarter of the globe.

A list is appended later on showing to some extent the exotic character of the Antillean Flora. The exotic flowers and ornamental shrubs and trees have not been enumerated. It may be mentioned, however, that many of the flowers which are supposed to be West Indian have, nevertheless, come from distant regions. For instance, the Barbados Pride came from the Cape Verde Islands; the West Indian Honeysuckle came from the Cape; the West Indian Hyacinth came from South America; and the Barbados Pink came from India.

Yet the West Indies may claim the parentage of some of the plants generally believed to have been only naturalized, since it is not always possible to say where a plant originated. Similar problems present themselves to shell collectors. Snails travel mysteriously across the wide seas, and the same species of seashells are picked up on beaches thousands of miles apart. Who can say, for instance, whether the Caribbean or the Mediterranean is the birthplace of the large and handsome shell *Triton variegatus?*

The mark of a cross (x) against a few names in the following list indicates that there are also native representatives of those kinds of plants, but that they have been supplemented or superseded by foreign species or varieties of a kindred nature. Tobacco is one of the plants so marked. The doubt about the derivation of the word from the island Tobago, or from Tabaco, in Mexico,

shows that it must have been found in the West Indies at a very early date.

In making out the list the Bahamas and the Caicos are regarded as West Indian Islands as much as the Greater or Lesser Antilles; but plants from Guiana or the other continental countries included by older writers in the West Indies are classified as exotics.

It is singular that so few plants whose medicinal virtues give them a commercial value figure in a list of West Indian exotics. A very large number of the native plants possess potent therapeutic properties, but these are generally unknown to Europeans.

In some cases a plant has been imported into one island from one place and from quite another part of the world into another. This, of course, is a point quite distinct from that of its original birthplace. It is difficult to determine the claims of any island to priority in respect to the first culture, and there is the same difficulty in assigning a date to the first introduction into the West Indies of cultivated herbs or trees. It is said in Loudon's Encyclopædia that sugar was first made in St. Thomas in 1610. The bread fruit and, perhaps, the akee were brought to the West Indies by Captain Bligh of *Bounty* celebrity in 1793. Schomburgk says the mango was cultivated in St. Vincent by Dr. Young in 1772; cinnamon plants, captured from the French, were sent to Jamaica by Lord Rodney in 1782; the violet, hyacinth, and narcissus were introduced into St. Domingo by Baron de Wimpfens in 1789; and the tamarind into Barbados in 1647.

The chief dispute, however, is about the honour of first having offered a throne to King Cane. Did he come from India to St. Thomas in 1610? Was the first Creole cane planted by Captain James Holdip, who brought it from Guiana to Barbados, before 1640? This seems to be the belief of Poyer in his History of Barbados, published in the end of the 18th century. Ligon, who visited that island in 1647, says that the culture of the cane began there in 1640, having just been introduced from Pernambuco in Brazil. Sir Dally Thomas, writing in 1690, says that a Hollander taught the Barbadians how to make sugar in 1640. It would appear that some colonists from Surinam further instructed them in this art and mystery in 1688. Schomburgk says that Colonel Sir Thomas Modyford carried the cane from Barbados to Jamaica in 1664, and that ten years after it was cultivated in Antigua by Colonel Codrington. It appears to have found its way from Antigua to St. Christopher (St. Kitts) soon after. Hughes, who wrote in the beginning of the 17th century, describes the diseases to which the

cane was then subject, including the moth-borer. He says that nobody could state whether the cane was a native of the East or West Indies. The fact that so notable a plant as the cane is claimed as aboriginal by both the Old and the New World is a very curious one, and opens up questions that lie far beyond the records of history.

We now give a list of valuable exotics cultivated in the West Indian Islands, together with the name of the country from which they originally came:

STAPLES.

NAME.	ORIGINAL COUNTRY.
Coffee	Arabia.
Cinnamon	Ceylon.
Clove	Molucca.
(x) Tobacco	Mexico.
Tamarind	India.
Divi Divi	South America.
Orange	Asia.
Lime	Asia.
Lemon	Asia.
Marmalade Orange	Asia.
Logwood	South America.
(x) Cotton	India, America.
Chocolate	South America.
Nutmeg	India.
Banana	India.
Cocoanut	India. Other hot countries.
Pine Apple	South America.
Aloes	Levant.
Ginger	India.
Tous-les-mois (Canna Edulis)	South America.
Arrowroot	South America.
Sugar Cane	India, China, Africa, South America.

FOODS.

(Not exported.)

Carrot	Britain.
Celery	Britain.
Parsley	Sardinia.
Lettuce	Britain.
Potato	Peru.
(x) Capsicum	India, China.
Tomato	South America.
Melongena	South America.
French Bean	Europe.
Green Peas	England.
Lima Bean	South America.

Name.	Original Country.
Increase Pea	Molucca.
Pigeon Pea	India.
Pinders	Africa.
Akee	Africa.
Beet	Europe.
Sorrel (Sabdariffa)	India.
Radish	Europe.
Cabbage	Europe.
Turnip	England.
Mustard	England.
Horseradish	England.
Water Cress	Europe.
Pumpkin	Levant.
Cucumber	India.
Squash	India.
Bread Fruit	South Sea Islands.
(x) Yams (White and Red)	India.
Plantain	India.
Shallot	Palestine.
Rocky Bolt (Rocambole)	Denmark.
Garlic	England.
Leek	Switzerland.
Chives	Europe.
Onion	Hungary.
(x) Roasting Eddoes	Ceylon.
(x) White Eddoes	South America.
Guinea Corn	India.
Maize	South America.

FRUITS.

Almond (Terminalia Catappa)	India.
Pomegranate	Africa.
Chinese Guava	China.
Malacca Apple	East Indies.
Mangosteen	South America.
Pear (Avocado)	South America.
Golden Apple	Society Islands.
Chili Plum	Chili.
Mango	India.
Shaddock	China.
Grape Fruit	China.
Mandarin (Orange)	China.
Tangerine (Orange)	China. (The name indicates Morocco.)
Governor Plum	Madagascar.
Garden Grape	Armenia.
Granadilla	South America.
Pawpaw	Asia.
Musk Melon	Asia.
Water Melon	Africa.

Name.	Original Country.
Fig	Mauritius.
Date	Africa.
Rosy Banana	China.
Dwarf Banana	China.

MISCELLANEOUS.

Myrtle	Persia.
Wormwood	Levant.
Tansy	Britain.
Peppermint	Europe.
Patchouli	India.
Lavender	Europe.
Basil	India.
Rosemary	Spain.

This list might be made longer by adding a few plants once cultivated for commercial purposes; also some that will, perhaps, be sources of profitable industries. In the first class are such names as the Betel from India and Copaiba from South America; in the second class would appear such names as the Egyptian Sesbania fibre, Kola from Guinea, and Tea from China.

Flora of St. Christopher (St. Kitts).—A writer in the *Temple Bar Magazine* (Feby., 1901) has been told that only 50 out of the 800 kinds of plants in St. Helena are indigenous. This is the more worthy of note on account of the isolation of that island, which would almost preclude the possibility of the introduction of foreign plants, except by human agency. He probably includes ferns in the 800, but no lower members of the vegetable kingdom, such as lichens and algæ. There are, perhaps, about 2,000 species and well-marked varieties of plants in St. Christopher, excluding from the count anything lower than a lycopod. Dr. Branch is of the opinion that about one-fourth of these were brought from other countries by man. It would be idle to speculate as to how many of those reckoned as indigenous were conveyed to these shores by natural agencies. It is not improbable, however, that some supposed importations from other islands are really natives.

The foreign element in the existing vegetation of a country cannot be estimated without paying attention to the number of exotics in its wild flora. The probabilities seem to be that nearly all the foreign plants in St. Helena are cultivated for use or ornamentation, but many of the exotics in St. Kitts are simply weeds and wild flowers. The original flora of one of the smaller members of the group of the Lesser Antilles must, *cæteris paribus*, be less varied

than that of a large island like Cuba or Jamaica. It ought therefore to be less varied in proportion to the given number of exotics than would be the case in a larger island. St. Kitts, nevertheless, not only abounds in wild plants, especially ferns, but a comparatively large proportion of them have been introduced.

Many of the wild exotics were accidentally planted by the hand of man. Others represent extinct industries. For example, the *Indigofera tinctoria* supplemented or superseded the native *Indigofera anil* when indigo was the chief staple of St. Kitts, as of the other Antillean islands; when it bore to sugar the relation of gold to silver, as explained in the letters of *The Young Squire of the 17th Century*. The *Opuntia coccinellifera* affords another illustration. It was cultivated here as a food for the cochineal insects when cochineal was a very saleable and valuable product. Colonists are likely to be men of inquiring minds and of more than average energy, and on the alert for anything likely to contribute to their profit or pleasure. A large number of the existing wild plants of foreign birth in St. Kitts represent unproductive experiments in horticulture or obsolete fashions in flowers.

The following are a few examples that may be cited in illustration. Hughes, in his History of Barbados, is indignant with a gentleman who had introduced into that island the Bastard Ipecacuanha of Jamaica under the impression that it was worth cultivating for its medicinal properties. As a matter of fact this weed (*Asclepias curassavica*) would be as serviceable as the real Ipecacuanha. Both it and the *Archippus* butterfly, whose caterpillar feeds on its leaves, are very common in Barbados, but rare in St. Kitts. Loudon says that the *Argemone Mexicana* is esteemed in its native country, Mexico, as a cure for cataract. Dr. MacFadyen, in his *Flora of Jamaica*, speaks of its seeds being useful as a hypnotic; it is now used only by the negroes in the treatment of sore eyes.

Sometimes the knowledge of the nature and commercial value of an herb has been quite lost. This is the case with the *Cassia obovata*, imported, according to Griesebach, from tropical Africa; even Doctor Sadler, of St. Kitts, does not seem to have known that it was one of the sources from which the senna of the drug store was prepared. In a fragmentary copy of Don's Botany, that belonged to Dr. Sadler, and is enriched with his manuscript notes, there is only the word *Blydog*, the vernacular name in St. Kitts at present, marked against this plant, whereas, judging from the doctor's other notes, it is reasonable to presume that had he known the real nature of the plant he would also have written "Senna."

The *Datura Tatula* and *Datura metel* abound by the roadsides near Basseterre. The former was brought from America and the latter from India as medicine; but they are now only weeds, though the negroes smoke their leaves, which they call "Fireweed," as well as those of *Datura stramonium*, for asthma.

Many a pretty flower brought from a distant land, and once highly prized, has been exiled from the garden to the field. [Whence a moral might be drawn.] The *Vinca Rosea* (an East Indian), which used to be called the Madagascar Periwinkle, and sometimes the Cayenne Jessamine, is now never seen, except in its white varieties, in a St. Kitts garden, but clothes many a fallow field with a beautiful pink and purple robe. The *Ipomœa dissecta*, from Georgia, may be seen thickly overrunning the fields from which the canes have just been cut; but in spite of its beauty of flower and leaf, and pleasant scent of noyau, no lover of flowers in Basseterre, except Doctor Branch, would give it a place in his garden. In the list of St. Kitts flora, published in BULLETIN No. 3, Vol. XXXIII, 1901, pages 207–219, giving the indigenous and imported plants in St. Kitts, there were some names of plants brought from the neighbouring islands. To this category belongs the purple plum or Mombia of Jamaica, mahogany from Santo Domingo, vanilla from Trinidad, the thatch palm from Anguilla, and the Seaforth's solanum and cabbage palm from Barbados.

Considerable diversity in both the fauna and the flora of the islands of the Antillean Archipelago would naturally be expected from the differences in their formation, physical characteristics, and situation. A difference in the fauna would be reflected in the flora, and conversely. If, for instance, a particular berry drifted from one island to another not frequented by any bird partial to that berry, the probability of the establishment of the plant would be lessened. On the other hand, birds blown from their native island to one in which their favourite berries were not to be found would on that account be seriously handicapped in the struggle for existence.

The specialization to particular islands of many of the snails of the Lesser Antilles is a very curious feature in their natural history. It is well marked among the islands comprising the Colony of the Leeward Islands, though they are so near each other. There is doubtless an intimate relation between the prevalence of particular plants and the snails in a given island. But this is a subject too full of intricacies to be discussed in this place.

General Conclusions.—The following are some of the general conclusions arrived at from a comparison of the native flora of the West Indies with that of the rest of the world. Only a certain number of Natural Orders are mentioned; these are selected on account of their size, or because they are representative of still larger groups of plants, or for some other special reason. The figures are, of course, only approximate, as calculations of this sort must vary in accordance with differences in opinion as to the limitations of orders, genera, species, and varieties, and also as to the indigenous or naturalized status of particular species.

(1) These islands have been fairly well supplied by nature with representatives of the three great orders: Leguminosæ, Compositæ, and Gramineæ. Of the first they can show over 80 genera, containing some 250 species; of the second, about 50 genera, with probably 120 species; and of the third, about 45 genera, with some 140 species.

(2) The following Natural Orders are moderately well represented in proportion to their size, viz.: Capparideæ, Bixineæ, Polygaleæ, Phytolaccaceæ, Chenopodiacæ, Nyctagineæ, Rhamneæ, Caryophylleæ, Tiliaceæ, Sterculiaceæ (including Buettneriaceæ), Sapindaceæ, Rutaceæ, Piperaceæ, Terebinthaceæ, Laurineæ, Passifloreæ, Loranthaceæ, Lobeliaceæ, Myrsineæ, Sapoteæ, Gentianeæ, Scrophularineæ, Boragineæ, Liliaceæ (including Amaryllids and Lycopodiaceæ).

(3) The botany of this region is not so strong as might have been expected in Cruciferæ, Cacteæ, Cucurbitaceæ, and Convolvulaceæ (with the exception of one genus).

(4) It is poor in Ranunculaceæ, Magnoliaceæ, Papaveraceæ, Myristiceæ, Umbelliferæ, Coniferæ, and Equisetaceæ.

(5) It has no Aurantiaceæ, Lineæ, nor Crassulaceæ. The orange tribe have all been imported; flax flowers are grown, but only from fresh seeds in some of the gardens, and the wild plant Bryophyllum Calycinum is the only one of the Crassulaceæ to be found in the fields, and it was brought here from Asia. Of the Junceæ only one representative is met with, and that came from Europe.

(6) The indigenous botany of these islands, moreover, is very poor in Nymphaeaceæ, Nelumbineæ, Rosaceæ, Violaceæ, Droseraceæ, Amentaceæ, Ampelideæ, Saxifrageæ, and Plantagineæ.

(7) But it is rich in Anonaceæ, Amarantaceæ, Malvaceæ, Urticaceæ, Myrtaceæ, Melastomaceæ, Apocynaceæ, Asclepiadeæ,

Solanaceæ, Bignoniaceæ, Acanthaceæ, Gesneraceæ, Labiatæ, Verbenaceæ, Aroideæ, Palmæ, Cyperaceæ, and Bromeliaceæ.

(8) It is very rich in Euphorbiaceæ, Rubiaceæ, Orchideæ, and Filices. Of the last mentioned it can boast about 350 native species, distributed in 48 genera.

The genera most prolific in species among the Exogens are Croton, Ipomæa, Solanum, Cassia, and Peperomia; among the Endogens, Epidendrum, Cyperus, and Panicum; among the Ferns, Aspidium, Polypodium, Asplenium, and Adiantum.

This list might be modified by a careful elimination of naturalized species on the one hand, or by the inclusion on the other hand of hybrids among the species. Ipomæa, for example, is given 46 species by Griesebach, but at least a dozen of these are shown by him to have been naturalized. He questions even the sweet potato's right to be considered an aboriginal West Indian. Ipomæa is a genus very prone to sport, and St. Kitts seems peculiarly well fitted to be a theatre for its proclivities. Nature and the florists have raised a great many hybrids, some of which will, no doubt, take rank some day as indubitable species. Don's Botany, published in 1831, gives 219 species in the whole world to Ipomæa. Hooker, in the Genera Plantarum of 1845, puts down the number as 300, after making a reduction from the 400 of other authorities. The probabilities are that a new census would show a considerable increase in the Ipomæan population in the world. Even little St. Kitts would, it is believed, contribute to this increase.

Renewed obligations are tendered to W. J. Branch, M.D., of Basseterre, St. Kitts, for favors extended in the preparation of this paper, as in the previous one. In fact, too much credit cannot be given to the Doctor, who is not only an eminent physician, but a naturalist of rare attainments as well; one whose love of nature is excelled only by his generous zeal as a helper.

Basseterre, St. Kitts, W. I., 1901.

NOTES ON ECONOMIC GEOGRAPHY.

BY

ALBERT PERRY BRIGHAM.

HYDROGRAPHY.—Part IV. of the 21st Annual Report of the United States Geological Survey is devoted to this subject. The work is in charge of Mr. F. H. Newell, whose work on Irrigation was lately noticed in the BULLETIN. A report on the progress of stream measurements for 1899 occupies 488 pages. The work is widely extended, but the stations for observation are most numerous in the Appalachians and in the arid West. Information is sought in order to facilitate the use of water for power, for irrigation, and for domestic supply. Among New England rivers we find data for the Kennebec, Merrimac, Connecticut, and others, while the Hudson, Mohawk, and Croton receive attention in New York. In all cases diagrams are employed to show the amount of discharge for all the months of the year, and variations within each month are shown in some detail. A good feature is the large number of hydrographic maps showing drainage of single basins, free from other and confusing detail. Such a map of the Croton basin, with its streams and reservoirs, appears on page 74. The upper Hudson is shown on page 71, and the Mohawk on page 64. The Illinois and its branches, grasping the country about the head of Lake Michigan, make a striking map, and this, like others in the report, is most valuable material for the teacher of geography. Nor should we overlook the large number of good photographs which have been reproduced to illustrate various phases of the subject. The figures include also many contoured maps of reservoir sites. The second paper in the volume is by Mr. N. H. Dorton, and relates to the Black Hills and surrounding country. A somewhat full description of the topography and geology is preparatory to an account of the water and other resources. The Hills are due to a central uplift, exposing a core of old rocks, while the younger formations dip away in all directions, and pass beneath the plains. Some of these are sandstones. Their exposure in the Hills, and their dip, which becomes less away from the centre of uplift, furnish artesian conditions which are described in detail for the several formations. The streams of the region furnish a con-

siderable surface supply for irrigation, and this could be increased by building suitable reservoirs.

Coal is the chief mineral of the sedimentary rocks of the region, and there are also found petroleum, gypsum, grindstone, and fuller's earth, with some promise of limestone suitable for lithographic work. A short account is given of the climate and the forests.

The volume concludes with an interesting paper by Mr. Willard D. Johnson, entitled "The High Plains and their Utilization," pp. 601–741. From the point of view of climate, the region is the sub-humid belt of Nebraska, Kansas, Texas, and New Mexico. Speaking in terms of physiography, the High Plains are the unsculptured remnants of the Great Plains. They are elevated and smooth grounds, with a dry climate erosion belt on the west, and a humid erosion belt, the prairies, on the east. They front the prairies by an easterly-facing escarpment, which led to their being called the High Plains.

In origin they are undestroyed parts of the débris slopes of the Rocky Mountains, and as land-forms are characteristic of an arid region. Streams from the mountains have wandered freely over these vast surfaces and made them what they are. These stream beds lie on a foundation of marine beds which have been tilted gently to the east and veneered with an alluvial cover. This cover sometimes attains a thickness of 500 feet. The smooth surface is preserved by the sod, while the bunch grass on the arid plains nearer the mountains gives no protection from erosion by rains and small streams. It is thus seen that Mr. Johnson rejects the widely-accepted lacustrine theory for the origin of these beds, about which in recent years there has been a growing scepticism. In particular, the frequent coarseness of the beds argues for their alluvial origin.

As distinguished from the still drier region on the west, the Plains became known as the rain belt, thus leading to several years of disastrous agricultural experiment. In the decade from 1885 to 1895 there was a rush into this territory, under the impression that crops could be raised without irrigation. This belief was strengthened by several seasons of exceptional rainfall, and it was thought that the climate was changing. But daily records of twenty-five years in some localities dispose of this view. Dry years are sure to follow the wet ones, and compensation cannot be had in the humid times for the losses of the dry periods.

We have here not so much a deficiency of rain as an excess of evaporation. The amount of rain is not the only factor in agricul-

ture. The Staked Plains have as much rainfall as the Dakota wheat lands, but are in effect much drier on account of the spasmodic character of the rains, greater evaporation, and lower relative humidity. The author gives graphic descriptions and some photographic illustrations of abandoned roads and town sites.

Irrigation is therefore essential to agriculture in this region, and this in turn is possible in but slight measure. The water cannot be had. Seepage and evaporation render storage impracticable. The streams from the mountains are not great rivers like the Nile or the Indian rivers which descend from the Himalayas. It is better economy to use the waters of the Arkansas river, for example, nearer the mountains, where the loss is less, and where better reservoir sites exist. Thus irrigation at Garden, Kansas, became impracticable because of increasing abstraction of the water in Colorado. The Canadian and Pecos rivers are not available for the Staked Plains. A very limited supply of water may be had from artesian wells, as in the case of the Meade Artesian Basin in Kansas, where there are several flowing wells; but these conditions are rare. A number of interesting small basins are due to ground settlement, and vary from the size of a buffalo wallow to a diameter of 1,000 yards or more. The author notes an interesting dependence on natural conditions for building materials. On the prairies the pioneer built of logs. In the "short grass" country—that is, on the High Plains—he uses sod, and in the arid belt, or "bunch grass" country, he must have recourse to "adobe," or sun-dried mud.

Mineral Resources of the Philippine Islands.—Part III. of the 21st Annual Report of the United States Geological Survey contains (pp. 487–625) a paper by George F. Becker on the Geology of the Philippine Islands. Mr. Becker spent fourteen months in the Archipelago, but was much hampered by the attitude of the natives and by the necessity of working under the protection of a military escort. He records his own observations, and seeks to compile all that is known of the geology of the region, chiefly from the researches of Spanish, German, and Austrian geologists. Pages 594–605 contain a bibliography of more than one hundred titles, with brief annotation. Mr. Becker gives an interesting notice of the volcanoes of the Philippines, stating that a considerable number have been active since the first occupation by the Spaniards. Mount Apo is the highest summit in the group, having an altitude of between ten and eleven thousand feet, the determinations not being in agreement. The cone is described as covered with sulphur above

7,500 feet. Solfataras and hot springs abound in certain localities. No pre-tertiary strata are known in the islands. A splendid series of marine terraces is seen about the Island of Cebú.

Black lignite is considered the most valuable mineral asset of the Philippines, and it occurs widely from southern Luzón southward. There are three of the more important known gold fields. A Spanish observer is quoted for the statement that "gold is found in moderate quantities nearly all over the Island of Luzón." In the Province of Lepanto both vein and placer gold occur. Among native miners "the Igorrotes are gifted with mechanical skill, and are not afraid of solid rock." For crushing, the natives have devised a kind of trip-hammer by attaching a heavy stone to a sapling. The only important known copper deposits are in the Province of Lepanto, where the veins have been worked by the Igorrotes. Brief notices of lead and iron are given, including a belt of magnetite in the mountains of Luzón. Petroleum occurs, but has been exploited little, if at all. The volcanoes will furnish large supplies of sulphur.

"The Coal Measures of the Philippines" is a report prepared by Charles H. Burritt, and transmitted to the Military Governor of the Islands. It is published by the War Department (269 pp). The report is largely historical, and an exposition, through numerous documents reproduced, of the slovenly and ineffective operations carried on under Spanish administration. Coal was first found in the Philippines in 1827, but the mining industry has its real beginning in 1853. Some Spanish observers began to see the value of the coal, and to urge that its proper development would bring increase of wealth, the growth of commerce, and habits of industry on the part of the natives. The best deposits are in Southern Luzón, where beds occur which are nearly 15 feet in thickness.

Agricultural Resources of Hawaii.—This is the subject of Bulletin No. 95, Office of Experiment Stations, U. S. Department of Agriculture. The author is Dr. Wm. C. Stubbs, director of the Louisiana Agricultural Experiment Stations. The extension of experiment work, the promotion of more varied agriculture and irrigation, are some of the special objects of the investigation. Sugar now furnishes more than 80 per cent. of the total exports. Coffee-growing is diminishing, and rice is not grown on approved modern methods. Dairying is unknown, and many forest areas have suffered unfortunate denudation. Irrigation methods are often expensive and wasteful.

The report opens with a convenient summary geographical

account of the islands, including the origin of the people, the geology, soils, climate, and rainfall. The fertile belts are near the ocean, and even these must, in many cases, be irrigated. The rainfall is exceedingly variable. On the windward or eastern side of Hawaii are points where the rainfall attains 300 inches. On the lee side, for 50 miles along the coast line, the rainfall amounts to about 4 inches per year. Such extremes may even occur within a few miles of each other. The flora is described as peculiar, "containing a larger proportion of endemic plants than any other known country." Excluding species introduced since Captain Cook's discovery of the islands, there remain 860 original species. Among plants of economic importance are many woods and fibre plants, some of the woods having great hardness and durability. The seedless breadfruit, the sugar cane, and the banana all reached the islands by human agency. Coffee flourishes, but is less extensively cultivated, owing to the greater profits of sugar production.

The water used in irrigation is often pumped from great depths. The coal is high in price, and watering is thus costly. In spite of this, over-watering is common to the injury of crops and of the soil itself. There are some artesian basins, as at Honolulu, where the water-bearing beds are about 500 feet below the surface. The trade in woods and the grazing of herds of domestic animals have led to an unhappy destruction of forests. Honolulu has made large expenditure in re-clothing with trees some of the adjacent mountain slopes. Re-forestation must, it is believed, be carried on systematically by the Government of the Territory. The problems of labour and the land laws also receive discussion. A number of maps are included, and the photographic illustration is good. Many views of fruits and trees are exceptionally fine. It is not often that reports of this nature contain so much interesting geographical material.

Soil Survey of the United States.—This work is carried on by the Division of Soils, United States Department of Agriculture. Professor Milton Whitney is the Chief of the Division, which has been recently established, and has just issued its second report (*Field Operations of the Division of Soils, 1900*). The report comprises a volume of 473 pages, accompanied by 24 maps in case. The object of this survey is to classify and map the soils of the United States, with such reference to climate, economic conditions, and special crops as to make the work of practical value to agriculture. The

Division is organized for work both on the east and the west of the Mississippi river, and also carries on a laboratory of soil physics and soil chemistry. In 1900, 4,460 square miles were surveyed at an average cost of $1.97 per square mile; and 17,000 copies of the report were printed, and the call for them has been active. Operations were carried on in 1900 in Arizona, California, Connecticut, Maryland, Massachusetts, New Mexico, North Carolina, Ohio, Pennsylvania, and Utah. The effort is made to co-operate with State surveys and experiment stations, thus serving local interests and securing unity. Following the report of the chief are reports on the several districts surveyed. These special chapters describe the local soil types, with notes upon their origin and use. Introductory studies of topography and geology are given, and there are commonly notices of climate, transportation facilities, of the social, industrial, and historical conditions.

The fundamental factor of soil differences is often neglected by the farmer, who is thus led to unprofitable labour. It is a chief object of the Soil Survey to discriminate the capabilities of soils and make available to all the results of experience, and thus lessen the sum of wasteful effort. It may be added that the reports on areas in Utah, Arizona, and California discuss questions of water supply, application of water, and the treatment of alkali soils.

ALBERT PERRY BRIGHAM.

NOTES ON CLIMATOLOGY.

BY

ROBERT DEC. WARD.

LOSS OF LIFE IN THE UNITED STATES BY LIGHTNING.—In 1890 the Weather Bureau began a statistical inquiry as to the number of fatalities caused by lightning in the United States, and this investigation was continued to the close of the year 1900. Considerable difficulty was naturally experienced in securing reliable data, but every effort was made to have the information as accurate as possible. The results for the earlier years were much more unreliable than those for the later ones, the data for 1899 and 1900 being especially complete. In a recent Bulletin of the Weather Bureau (No. 30. *Loss of Life in the United States by Lightning*) Professor A. J. Henry summarizes the statistics thus far gathered, and considers the geographical distribution of lightning strokes—a subject which he also treats cartographically for the first time.

During the year 1900, 713 persons were killed by, or received fatal injuries through, lightning. Of this number, 291 persons were killed in the open, 158 in houses, 57 under trees, and 56 in barns. The circumstances attending the death of the remaining 151 are not known. Nine hundred and seventy-three persons were more or less injured by lightning during the year, and of this number 327 received their injuries while in houses, 243 in the open, 57 in barns, and 29 under trees. The circumstances attending the injury of the remaining 317 cases are not known. On the average, it is probable that from 700 to 800 lives are lost each year by lightning in the United States.

Tabulating the average mortality resulting from lightning according to geographic districts having the same, or nearly the same, atmospheric conditions, it appears that the greatest number of fatalities occurred in the Middle Atlantic States; the next greatest in the Ohio Valley and Tennessee, with the middle and upper Mississippi Valley a close third. The greatest number of deaths in any single State during the next five years, 1896–1900, occurred in Pennsylvania (186), followed by Ohio with 135, and Indiana, Illinois, and New York with 124 each.

The average number of deaths from lightning per unit area (10,000 sq. miles) is 1 in the Gulf States. In New England, with

probably half as many thunderstorms, the death-rate per unit area is 2. In the latter district the death-rate per million of rural inhabitants is nearly double that per million of total population, and the same holds true of the densely-populated districts of the Middle Atlantic States. Considering both unit area and density of population, the greatest mortality from lightning is in the Ohio Valley and the Middle Atlantic States. If, however, the density of population alone be considered, it is in the upper Missouri Valley and the middle Rocky Mountain region.

The *Bulletin* also gives a brief discussion of thunderstorms in general, especially as related to their electrical phenomena, and calls attention to a few simple precautions against danger that may be exercised by the individual.

THE AGRICULTURAL POSSIBILITIES OF ALASKA.—Increasing attention is being paid to the future possibilities of the great Territory of Alaska, and one of the questions of most interest in this connection concerns the agricultural outlook in that region. Can Alaska ever become a farming country, or is its commercial value to lie altogether in its mines, its fisheries, and its animal life? To the climatologist the agricultural problem is naturally the one of greatest concern. Two rather divergent views on this subject are presented in the March number of the National Geographic Magazine. In an article on *The Possibilities of Alaska*, by C. C. Georgeson, Special Agent of the Department of Agriculture in Charge of Alaska Investigations, the writer gives an enthusiastic account of the success which he finds to have attended farming ventures in different parts of the Territory. Cattle feeding in grass so tall that it reached above their backs; magnificent native-grown potatoes, carrots, beets, cauliflowers, peas, lettuce and radishes, and normal wheat, oats, barley, and rye were seen during the summer. Mr. Georgeson states that hardy vegetables are successfully raised all over Alaska south of the Arctic Circle, except on the coast of Bering Sea, and concludes by comparing the future agricultural conditions of Alaska with those of Finland at the present time, the former region having, in the opinion of Mr. Georgeson, more favourable conditions from an agricultural standpoint than the latter.

A more conservative view, and one which those who have made a study of the climate of Alaska will be more ready to accept, is that of Mr. Henry Gannett, as set forth in a brief note on *Agriculture in Alaska* in the same number of the National Geographic

Magazine. Mr. Gannett sums up the whole matter in the following words, which are here quoted because they so well express what may be called the reasonable scientific view of the matter:

> While it is admittedly true that hardy grains and vegetables have been brought to maturity at various points on the coast and in the interior, the climate must always prevent this northwestern territory from becoming a successful farming region. To be successful farm products must be grown at a less expense than they can be raised in California, Oregon, or Washington, *plus* the cost of transportation. We do not think that Professor Georgeson would maintain that farmers upon the Alaskan coast could compete in their home markets with the Pacific States. In the interior of Alaska, where climatic conditions are more favorable than upon the coast, the summers being hotter and less moist, and where home products would be protected by higher transportation rates, it may be possible to maintain successful competition—although that is a matter yet to be demonstrated.

Climate of Western Australia.—A publication of considerable importance to climatologists is that on *The Climate of Western Australia*, recently issued from the Perth (W. A.) Observatory by W. Ernest Cooke, Government Astronomer for Western Australia. This is the first comprehensive report on the climate of this region. Annual meteorological summaries have been issued since 1876, but the present volume comprises a selection and co-ordination of the principal meteorological facts which have been discovered during the past twenty-four years of observation. A large number of tables are given showing the monthly and annual means and extremes of the different meteorological elements, and the distribution of these elements is also shown by maps. The records naturally refer mostly to stations in the vicinity of the coast, the inland districts being still to a great extent unrepresented. A series of seventeen weather maps illustrates the weather types of the district under consideration. There are two distinct types of weather—the winter and the summer—although each of these is, of course, subject to almost endless modification. Among the tables one of special interest shows the duration of the "heat waves" which have passed over Perth since Jan. 1, 1880. The longest of these spells without a break occurred in 1896, when the maximum temperature exceeded 90° on every day between January 25 and February 12, nineteen days in all; but the most severe heat was apparently in January and February, 1880, when the maxima on several days rose over 100°, and on two days over 110°. It may be noted, however, that hot nights are exceptional, even during these hot waves, the minima being usually between 60° and 70°.

The heaviest fall of rain ever recorded in Western Australia was

36.49 inches, near Cossack, April 2–3, 1898. On the other hand, only 0.73 inch was recorded in this same district during twenty months ending January, 1892.

SOME PHYSIOLOGICAL EFFECTS OF SUNSHINE AND SHADE.—It has long been well known that differences in exposure to sunshine have marked effects upon vegetation, but hitherto practically no attention has been paid to any effects which may be noted upon the characteristics of the human beings who live under different conditions of insolation in the same general district. Some very interesting facts in this connection are brought out in a recent paper by M. Lugeon, professor at the University of Lausanne, entitled *Quelques Mots sur le Groupement de la Population du Valais* (Etrennes helvétiques pour 1902). A study of the principal valley of the canton, between Martigny and the Rhone Glacier, brings out some evident effects of exposure. Statistics show a population of about 20,000 on the left bank and 34,000 on the right bank of the river. A part of this difference is doubtless due to the fact that the right bank is less steep, and hence more open to settlement, but the major part is believed by M. Lugeon to result from the difference in the exposure to sunshine. In a certain district in this same valley the slopes on both sides are about equally steep, but the population on the sunny side is about 3,000, while that on the shady side is between 700 and 800. With one or two exceptions all the villages are on the sunny side. In fact, a certain distinction of classes results from this difference in the conditions of insolation. There is developed an aristocracy of the sun, so to speak. The people who live on the sunny side are, on the whole, more prosperous and better educated. They of the *Sonnenseite* look with some contempt upon the poorer people on the *Schattenseite*. The village of Reckingen contains two real castes, the distinction between which rests ultimately upon the difference in exposure to sunshine.

THE MEXICAN BELT OF CALMS.—In the region east of the 120th meridian, in the North Pacific Ocean, and between the coast of Central America and Mexico and the Equator, there is a belt of calms and of variable winds which is a source of great delay to all sailing vessels which have occasion to pass over that portion of the ocean. This belt is called the Mexican Belt of Calms. It forms part of the general equatorial belt of low pressure which encircles the globe, and it lies between the anticyclones of the North and

South Pacific Oceans. On the *Pilot Chart of the North Pacific Ocean for April*, Mr. James Page considers this Mexican belt of calms, and gives charts showing, for winter and summer, the percentage of calms and light winds for each 5-degree square throughout the area in question. The shape of the belt is generally triangular, the base resting on the American coast and stretching from Cape San Lucas to the Gulf of Panama. The vertex is in longitude 120°–125° W., and in a latitude varying with the season, being further north in summer and further south in winter. The percentage of calms and of light airs is always greater near the coast, but close alongshore the prevailing land and sea breezes serve to diminish the frequency of calms, and may be taken advantage of by vessels making trips between the coast ports of Mexico and Central America. The occurrence of these land and sea breezes, although such winds are of minor importance in the general wind system of the world as a whole, is thus very helpful to navigators in this particular ocean area.

CENSUS STATISTICS OF AGRICULTURE.

BY

HENRY GANNETT.

The Census Office has been for some time giving in instalments the leading statistics of agriculture. These are here brought together in a general presentation of the subject.

The total number of farms in the United States in 1900 was 5,739,657—an increase of 25.7 per cent. over the number in 1890. This rate of increase in number of farms was decidedly greater than the increase of population. The total area of farms was 841,201,546 acres—an increase of 35 per cent. over 1890. This rate of increase was much greater than that of the number of farms, indicating a decided increase in the average size of farms. In 1900 the average size of farms was 146.6 acres, while in 1890 it was 137 acres, and in 1880 slightly less, showing, for the past twenty years, an increase in the average size of farms. The area in farms was 43.8 per cent. of the area of the country. In different States the proportion of the total area which is included within farms has a wide range, being in such States as Iowa and Illinois practically the whole area of the State, with the exception of that occupied by roads, railroads, and town sites, while in the sparsely-settled States it forms but a small proportion.

The average size of farms, too, differs widely, being, as a rule, much larger in the sparsely-settled States, where, under the term of farm, are included great cattle ranches as well as the small irrigated farms, the average size of farm in Wyoming being 1,333 acres, in Nevada 1,175 acres. In Kansas the area drops to 240 acres, in Iowa to 151 acres, in Illinois to 124 acres, while in New England, where the farms are little more than market gardens, the area is still less. Southern farms range in area from 75 to 100 acres in State averages.

The total area of improved land in the country was, in 1900, 414,793,191 acres, or 49.3 per cent; very nearly one-half of the total area in farms. This was 21.6 per cent., or more than one-fifth of the area of the country. The area of improved land has, however, increased in the past ten years only 16 per cent., being at a much smaller rate than the increase of population, and the average area of improved land per farm was but 72 acres in 1900,

against 78 acres per farm in 1890. Thus, although the area of farms has increased, that of improved land per farm has diminished.

The proportion of improved land differs widely in different States with the density of population, and with the relative importance attaching to the agricultural industry, together with the character of the surface. The highest percentage is found in Iowa, which is a typical prairie State, in which practically all the land is available for agricultural purposes. Not less than 84 per cent. of the whole area of the State is improved. Next to this is Illinois, of which almost as large a proportion is susceptible of cultivation. Here the proportion is 77; in Indiana it is 73 per cent., and in Ohio 74 per cent. These States are the most highly cultivated of all the States in the Union, the proportion of improved land diminishing in every direction. In New York the percentage drops to 51, in Pennsylvania to 46. In the States of the Cotton Belt the proportion of improved land ranges from a fourth to a third of the area; the smallest proportions are, of course, found in the sparsely-settled Rocky Mountain States, where are New Mexico and Nevada, with less than one per cent., Wyoming with one per cent., Utah and Montana with 2 per cent.

Of all the farms in the United States, 64.7 per cent. were occupied by their owners, 13.12 per cent. were occupied by tenants paying cash rentals, and the remainder, 22.18 per cent., with share tenants. These figures show great changes in the past ten years. In 1890, 71.6 per cent. of the farms were occupied by their owners, 9.96 per cent. were occupied by cash tenants, and 18.41 per cent. by share tenants, showing a decided movement away from the ownership of farms, and toward renting them. These changes are widespread. In nearly every State in the Union fewer farms are owned by their occupants than there were ten years ago, the only exceptions being Maine, New Hampshire, and Vermont, in which States the owned farms are slightly more numerous than ten years ago. The ownership of farms is most general in the Far West, while the renting of farms is commonest in the Southern States. In the latter group of States, taken as a whole, not far from one-half of the farms are rented. The meaning of this great and general increase in the proportion of rented farms is not apparent. It cannot be a result of extensive foreclosure of farm mortgages, since it is quite as great in States where mortgages were few as where they were many. Whatever be the cause, it is certainly a startling phenomenon.

Of the total number of farms in the United States, 86.4 per cent. were occupied by whites and 13.4 per cent. by negroes, the proportion of negro farms being a little in excess of the proportion of negroes, which is due to the well-known fact that nearly all negroes are engaged in agriculture, while a large part of the white population are in other callings. The average size of farm of the two races differs greatly, that of whites being 160.7 acres and that of negroes being only 55 acres. Of the white farms, 70.5 per cent. were owned by their occupants, 29.5 per cent. being rented. Of the negro farms, on the other hand, only 25.4 were owned, and not less than 74.4 per cent. were rented. It is to be regretted that we have no similar figures at hand for 1890 for comparison; but that the increase in rented farms is not confined to negroes is shown by the fact that it extends to nearly all the Northern States, in which there are very few negro farms.

The total value of farm property in 1900 was $20,514,001,838—an increase of 28.3 per cent. since 1890. The average value per farm was $3,574. Farm land had a value of $13,114,492,056, or an average value per acre of $15.60. This differs widely among the different States. Farm land has the greatest value in Illinois, $46.17 per acre. In Iowa the value is $36.35; in Ohio, $33.35; in New Jersey, $32.86; and in Indiana, $31.81. In no other State does it exceed $30.00 per acre. In Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, Maryland, Delaware, Michigan, Wisconsin, Minnesota, and California the value ranges from $10 to $20. In the Southern States, with scarcely an exception, the value is less than $10.

Farm buildings were collectively valued at $3,560,198,191, implements and machinery at $761,261,550, and live stock at $3,078,050,041. Implements and machinery have increased in value in the past ten years not less than 54 per cent., more than double the increase in the number of farms, showing a relatively greater increase in the case of farm machinery. The value of live stock shows an increase of 40 per cent.

The total value of products in 1900 was $4,739,118,752. Of this amount, $974,941,046 was fed to live stock, and therefore appears in duplicate. Subtracting this there remains as the net value of farm products $3,764,177,706, which is 18.3 per cent. of the farm capital. The average net product per farm was $656, and per acre of improved land $9.

The proportion which the gross farm income bore to the value of farms differs widely in different States. It was highest in the

Cotton States. In Alabama and Mississippi it exceeded 50 per cent., and in Arkansas, Georgia, and South Carolina 40 per cent. In Florida, North Carolina, Louisiana, and Tennessee, with Maine and Vermont in the North, the farms earned between 30 and 40 per cent., while in the great prairie States, the richest agricultural States of the Union, the proportion was less than 30 per cent., and in Illinois and Iowa, probably the richest of all, the proportions were but 17 and 20 per cent. respectively. The smallest proportion was found in California, 16.5 per cent.

The following table gives the amounts of the principal crops:

Wheat, bushels	658,534,252
Corn, "	2,666,440,279
Oats, "	943,389,375
Rye, "	25,568,625
Barley, "	119,634,877
Buckwheat, "	11,233,515
Cotton, bales	9,534,707
Hay and forage, tons	84,011,299
Potatoes, bushels	273,328,307
Irish potatoes, bushels	42,526,696
Onions, bushels	11,791,121
Tobacco, pounds	868,163,275

The wheat crop of Minnesota is far the largest of all, exceeding 95 million bushels, or one-seventh of the total product of the United States. North Dakota is next with about one-eleventh. Wheat was raised for export, *i. e.*, in excess of the needs of the population, in 16 States; in Minnesota, the Dakotas, Nebraska, Kansas, Iowa, Missouri, Indiana, Ohio, Michigan, Oklahoma, Colorado, Idaho, and the three Pacific coast States. The crop of these States supplies not only their own populations, but the deficiencies of other States and exports to Europe, amounting to about 150 million bushels.

Corn was raised in quantity in every State and Territory, and was probably the most valuable of all crops. The banner States were Illinois, with 398 million bushels, and Iowa, with 383 million bushels. Besides these Kansas, Nebraska, and Missouri each produced over 200 million bushels. These five States together contributed much more than half the corn crop.

Oats, also, were produced in all the States, although in small quantity in the South. The leading States in this cereal, as in corn, were Illinois with 180 million, and Iowa with 168 million bushels.

Other States of great importance in this crop were Minnesota, Nebraska, and Wisconsin, three-fifths of the oats of the country coming from the five States named.

Barley is produced mainly by California, Minnesota, Iowa, and Wisconsin, nearly three-fourths of the entire crop coming from these four States.

Rye and buckwheat are of little relative importance.

Nearly all of the cotton was produced in the Carolinas, Georgia, Alabama, Mississippi, Louisiana, Texas, and Arkansas. Of these States, Texas, with its enormous area and virgin soil, is far in the lead with 26 per cent. of the entire crop. The following table shows the production of each of these States in percentages of the total crop:

Alabama	12 per cent.
Arkansas	7 "
Florida	1 "
Georgia	13 "
Indian Territory	2 "
Louisiana	7 "
Mississippi	14 "
North Carolina	5 "
Oklahoma	1 "
South Carolina	9 "
Tennessee	2 "
Texas	26 "

Hay and forage crops, among the most valuable of the products of agriculture, are raised in every State and Territory. The crop is composed of several items, as follows, expressed in percentages of the total crop :

Wild, salt, and prairie grasses	21 per cent.
Millet and Hungarian "	3 "
Alfalfa or lucerne	6 "
Clover	6 "
Other cultivated grasses	44 "
Other forage crops	20 "

Tobacco is produced, in greater or less amount, in most of the States, but in commercial quantity in but few. Kentucky raised 36 per cent. of the crop, North Carolina 15 per cent., and Virginia the same proportion, the three States collectively contributing not less than two-thirds of the tobacco of the country.

The numbers of domestic animals upon farms, in 1900, were as follows:

Neat cattle	67,822,336
Dairy cows	17,139,674
Horses	18,280,007
Mules	3,271,121
Asses and burros	95,603
Sheep	61,605,811
Swine	62,876,108
Goats	1,871,252

Of neat cattle, Texas contained 9,428,196—a number far larger than that of any other State. Iowa contained 5,367,630, and Kansas 4,491,078. Texas contained more cattle than all the Rocky Mountain and Pacific coast States together. The days when most of the beef was raised on the public, free range, are nearly over in this country. That this is true is seen from the statement that in the Central States, North and South, there were 45½ million cattle, while in the West there were but 8½ millions.

Horses were distributed with some approach to uniformity. In Iowa, Illinois, and Texas there were about 4 millions out of 18¼ millions, and more than half the total number were in the North Central States.

Mules are in great part peculiar to the South; nearly three-fourths of the total number being in the Southern States, and more than half in the South Central States.

Of sheep, more than half the number in the United States, 33½ millions, were found in the Western States, and more than one-fourth in the North Central States. The greatest number were in Montana 6,170,483; Wyoming 5,099,613, and New Mexico 4,899,487.

Of swine, nearly two-thirds were in the North Central States, and more than one-fifth in the South Central States. The largest number in any State was in Iowa, 9,723,791.

The total value of animals sold and slaughtered in the census year was $912,786,424, or 31 per cent. of the total value of live stock.

GEOGRAPHICAL RECORD.

THE VOLCANIC ERUPTIONS.

MARTINIQUE.—While the permanent records of the recent volcanic outbursts in the West Indies can be written only after the termination of the present period of violence gives an opportunity for thorough investigation, a preliminary statement of these occurrences will not be without present value. The statements given here are condensed from those reports in the newspaper press that have been verified, from brief interviews with Professor Robert T. Hill, of the United States Geological Survey; Dr. Thomas A. Jaggar, of the Geological Department of Harvard University; and Professor Angelo Heilprin, of Philadelphia; and from communications that have appeared in *Science* and *Nature*.

On April 18th last, severe earthquake shocks in Guatemala killed many persons and destroyed a large amount of property. The earthquake waves emanating from this region were recorded by seismographs at Baltimore, over 1,700 miles from the scene of disturbance, the Island of Martinique being about the same distance from Guatemala. The earth-billows were also recorded at Toronto, Victoria, B. C., and other distant places, showing that, whether or not the Guatemala earthquakes had any influence in precipitating the subterranean disturbances in the West Indies, the earth tremors doubtless extended beneath the Caribbean Sea floor, as well as to other regions more distant from the place of origin of the shocks.

La Montagne* Pelée, the highest of the "400 mountains of Martinique," is a volcanic cone rising 4,420 feet above the sea. It stands in the centre of the north end of the island, about five miles from the north coast, and the same distance from the port of St. Pierre on the northwest coast. The drainage from the southern slopes of the mountain reaches the sea through St. Pierre, or through the coastal plain a little to the north of it. The mountain is what is called a tuff cone, made up of volcanic dust and other fragmental rocks ejected during former eruptions. In type, therefore, the volcano differs from those in Hawaii, for example, which were built up by lava flows, and also from Vesuvius, which is composed of a mixture of lava and fragmental rocks. Within historic

* If the *Montagne* is to be turned into *Mont* in English reports, respect for grammar demands that *Pelée* be printed *Pelé*.—(ED. BULLETIN.)

times Mont Pelé has shown little activity. It rained dust over St. Pierre in 1851, the ejectamenta coming from La Soufrière crater on the slope of the mountain. The crater at the top was occupied by a small lake. There is no record that this crater has been active since the discovery of the island until the great outburst of May last. St. Pierre, however, was not destroyed by outpourings from the top of the mountain, but from a new crater on the southern slope. At rare intervals the people were somewhat alarmed by roarings accompanying the emission of steam.

The first signs of disturbance, this year, were in the last days of April, when steam was observed on the mountain and rumbling sounds were heard. The people of St. Pierre, however, were not seriously disquieted till May 3, when dense masses of steam arose above Mont Pelé, and the sky was darkened and the mountain hidden from view by steam clouds and dust. This phenomenon continued on May 4, scoria and dust sifting over the city to a depth of one-quarter of an inch.

On May 5 an immense volume of hot mud and water, issuing from a crater on the south slope, poured down the southwest side of the mountain, to a depth, it is said, of twenty feet. It followed the bed of the River Blanche, whose waters had been discoloured for several days by outpourings from the mountain. Plantations, buildings, and people were overwhelmed. In about three minutes the avalanche reached the sea, burying out of sight the Guerin sugar factory at the mouth of the River Blanche, about a mile northwest of St. Pierre. The number of persons killed at the factory was twenty-three, but the total number of victims is not known.

Meanwhile the mayor of the city and the daily newspaper *Les Colonies* were constantly assuring the people that there was no danger. A committee of investigation reported that the eruptions were normal and portended no menace to the city. M. Laudes, "the distinguished professor of the Lyceum," in an interview printed in *Les Colonies*, advised that residents remove from valleys on the lower mountain slope to avoid possible submergence by "muddy lava." He added that "Mont Pelé offers no more danger to the inhabitants of St. Pierre than Vesuvius offers to those of Naples." The people were intensely anxious, but a panic was averted by reiterations, till the very hour of destruction, that St. Pierre was in no danger. About 300 persons saved their lives by leaving St. Pierre before May 8. The exodus was characterized by the local newspaper as "mad and foolish."

On Thursday, May 8, at 8 o'clock in the morning, St. Pierre, with its population estimated at from 26,000 to 30,000 souls, was entirely destroyed by a terrific outburst from Mont Pelé. Only one person, a negress, was found alive, and she died soon after being removed from the basement in which her sufferings had been prolonged. Eighteen vessels, besides small coasting craft, were riding at anchor in the roadstead. All were destroyed except one, which succeeded in reaching the open sea, with most of its crew badly burned. A few sailors who had jumped overboard from burning vessels were saved late on the day of the catastrophe.

The city was involved in almost impenetrable darkness throughout that day. It is believed to have been practically reduced to ruins within ten to fifteen minutes after the blast from the mountain struck it, though combustible material was burning for two or three days. All animal life was probably extinguished within a very few minutes.

The destruction of St. Pierre was due to a new crater on the south side of the mountain, about half-way between the top and the city; in other words, only about three miles from the northern end of the town. The examination of the ruins shows that the superheated blast of steam, dust, stones, and gases projected upon the city must have been propelled with an energy equal to that of the most terrific tornado. Walls three feet thick were carried across streets and added to the ruins on the other side. A great many of the house walls were very thick, but nearly all that were not overturned on May 8 were destroyed in the second great eruption on May 20. The guns in a battery on a hill south of St. Pierre were dismounted and carried for rods. Heaps of volcanic dust were piled up against the north side of every ruined wall. Fire destroyed everything combustible except some of the tree trunks, though, curiously enough, the bodies of some of the victims, with their clothing, were only partly burned.

Dr. Jaggar is of the opinion that St. Pierre was destroyed by an explosive volcanic tornado. There was no lava flow; no molten matter poured from the lip of the new crater, but volcanic dust was everywhere. Professor Kemp, of Columbia University, commenting upon the preliminary statements made by observers sent to the island by the National Geographic Society and other bodies, said:

> What was expelled was dust mixed with steam and speedily turned into mud, finely-broken rock and gases of a highly-inflammable sort. The tremendous force of the outburst from some point beneath the surface carried with it immense quantities of the material of which the cone was composed, scattering it to great distances.

The lightnings and detonations are regarded by some of the observers as the result of the union—with explosive force—of gases with oxygen, a phenomenon that is believed to have hastened the ruin of the city and the extinction of animal life. Enormous quantities of hot black mud were also poured out of the new crater, a great deal of the destruction in the northern part of the city being due to these avalanches.

According to Professor Hill, the zone of complete destruction is in the form of an elongated oval extending partly over the sea and embracing eight square miles of land surface. As both the crater at the peak and the new crater on the slope were in eruption, the zone of total destruction on land extends from the top of the mountain to the coast at Le Prêcheur in the north and to Carbet in the south, a distance of between six and seven miles. Counting from south to north, St. Pierre occupied the second mile of this devastated coast line. All vegetable and animal life was annihilated in the area between this part of the coast and the top of the mountain. In a zone outside this region vegetation was badly injured, but not wholly destroyed; still farther away dust and stones fell, but no injury was done. Hundreds of fumaroles, or miniature volcanoes, opened new areas of active vulcanism on the south slope of the mountain. The most conspicuous ejectamenta from the new crater during the remainder of May were large volumes of black hot mud, which poured down the valleys and into the sea. The old crater at the top ejected steam, mud, pumice, and lapilli (scoriaceous fragments about a half-inch in diameter), but no lava. The salient topography of the region has not been altered.

Violent eruptions of Mont Pelé occurred on May 20, 26, 28, and on later days. It is believed that the period of large activity may continue for some time. The eruption of May 20, exactly similar to that of May 8 and probably of equal violence, completed the destruction of the walls of St. Pierre and covered much of the island with dust. A heavy pall of dust clouds hung over Fort de France, the capital of the island, about fourteen miles from the top of Mont Pelé; many small stones fell at Fort de France both on May 8 and May 20.

La Soufrière.—If it had not been for the awful destruction of life at St. Pierre on May 8 the great catastrophe which occurred on the little island of St. Vincent, about twenty-four hours earlier, would have fixed the attention of the world upon that spot. La Soufrière, the volcano at the northern extremity of St. Vincent,

about ninety miles south of Mont Pelé, had been quiescent since 1812, when a tremendous eruption destroyed the east end of the island and buried St. Vincent under a thick layer of volcanic dust. Several weeks before the eruption of May 7 last rumblings and slight earthquakes had given warning of disquietude; on May 6 there was a severe earthquake, and steam and dust were violently ejected from the crater. On the following day eruptions of extreme violence occurred and about 1,700 persons were killed, mostly on the eastern or windward side of the island, by avalanches of hot mud and the explosive and deadly gases that accompanied the outbursts. A number of villages were buried under mud, and life was destroyed in a large part of the northern third of the island. The loss of life would have been much greater if many of the people had not fled to the south before the great catastrophe came.

On the island of St. Lucia, which lies midway between these two areas of volcanic activity, the boiling sulphur springs and volcanoes remain in their normal condition. The dust clouds from La Soufrière are said to have been driven to a height of eight miles, much of the dust getting into the eastward-moving current of the upper air, where it was carried 100 miles east to Barbados and scattered over that island to a depth of several inches. The detonations in St. Vincent and Martinique were heard as far away as Barbados.

ERUPTIONS IN ALASKA.—Some degree of activity is reported, this season, along the eastern part of the volcanic belt which extends through the Aleutian chain and Cook Inlet to Mount Wrangell. The volcanoes said to have been in eruption extend from Augustine Island, at the entrance to Cook Inlet, to Mount Blackburn, thirty miles southeast of Mount Wrangell, a distance of about 200 miles. Mr. Spencer, of the Geological Survey, who visited Blackburn in 1900, expresses doubt of the accuracy of the report that it has become an active volcano. He says it is composed of limestones, shales, and various igneous rocks, and he did not think, when he saw it, that it could properly be classed even as an extinct volcano. Mount Redoubt, also reported to be active, lies to the west of Cook Inlet, and is nearer to the well-known Iliamna on that inlet than to any other active volcano.

POPULAR ACCOUNTS OF THE ERUPTIONS.—Certain words and phrases used in the newspaper reports of the eruptions, some of which were excellent, might better have been avoided, as they were likely to convey a wrong impression. It is well not to apply the

word "ashes" to the ejectamenta of a volcano, as the idea may be imparted that the so-called ashes are the residue of combustion, while in fact they consist of the finer particles of the ejected matter, and may, more properly, be called volcanic dust. The word "smoke" is often wrongly applied to the steam, whose apparent blackness is due to the vast quantities of dust or stones that are shot out of the crater with it. Some reports also spoke of flames shooting up from the crater of Mont Pelé. This may have been correct as applied in the description of these eruptions. Professor Russell says, in his *Volcanoes of North America*, that Fouqué, at the eruption of Santorin, in 1866, first established the existence of true volcanic flames, due principally to the combustion of free hydrogen. Sulphuretted hydrogen may also be emitted, and, being inflammable, sometimes burns with a bluish flame. Professor Russell adds that, except in these cases of combustion, very little actual burning accompanies volcanic eruptions, and it is of minor importance as a part of the spectacle witnessed. When we read of flames pouring out of craters, the cause of the phenomenon, in many cases, is the reflection on the steam clouds above the crater of the molten lava beneath.

EUROPE.

RUSSIAN EMIGRATION TO SIBERIA.—Much attention has been attracted, in recent years, to the very large movement of Russian peasants to new homes in Siberia. In 1900 the number of emigrants reached the enormous total of 219,263 persons. These peasants, living in their villages in Russia, are impressed with the idea that they would be more prosperous on the wide and fertile lands which are open for settlement in Siberia. The difficulties of emigration have been largely removed by the Trans-Siberian railroad, which has reduced to days a journey that would formerly have required months. The cost of the journey is very small. An adult pays a fare of only four roubles between Moscow and Omsk, a distance of 1,800 miles. Children under ten years of age are carried free. The rates on baggage are also insignificant. On the other hand, the freight rates on live animals are comparatively high. The price for transporting a horse is three times the cost of an emigrant's ticket. The emigrant, therefore, sells his horse in Russia, and with the money he can buy three, and sometimes four, horses in Siberia.

Most of this emigration is from the fertile black earth region in central Russia, the largest numbers going, in 1900, from the Governments of Poltava (33,631), Kursk (19,903), Chernigov (16,585),

Mohilev (16,358), Kharkov (15,438), Vitebsk (11,876), and Voronezh (10,810).

Thus it is not the largest or the least fertile provinces that supply the most emigrants. The movement comes from all the European portions of the empire, excepting Finland and Poland; but it is smallest in the provinces that are nearest to St. Petersburg and Moscow, those great cities having more attractions than far-off Siberia for the neighbouring peasantry who may desire to leave their villages. Considerably more than half of the emigrants are males.

The emigrants scatter through Siberia from the Urals to the Pacific; but the fertile lands of West Siberia, particularly in the Government of Tomsk and Akmolinsk, and the neighbouring lands of Yenisei Government, in east Siberia, are especially attractive to them. More than half of them in 1900 settled in these three provinces. In the Tomsk Government, where over 75,000 emigrants settled in that year, a large area of excellent land, known as the "Lands of the Imperial Cabinet," is now open to the newcomers.

The first work before the emigrants is to erect their habitations, begin cattle-raising, and plough their new lands. It is found that if the colonists harvest two or three good crops they seem content to remain as permanent settlers; but if their new life begins with a bad season, like that of 1901, when drought destroyed their crops, they are likely to return to Europe.—(*Ann. de Géog.*, 1902, No. 56, pp. 173–77.)

ASIA.

THE MAMMOTH IN SIBERIA.—*Petermanns Mitteilungen* (1902, p. 47) reports the arrival at Sredne Kolymsk on October 28 last of the expedition sent out by the Imperial Russian Academy to bring to St. Petersburg the remains of the mammoth found not far from that place by the Cossack Yawlowski. The party had found the remains and brought them to Sredne Kolymsk, which is on the Kolyma river, east of the Lena. Since its discovery the body had not been properly protected, and wild animals had eaten much of the flesh; but few of the bones were missing, and enough of the thick hairy covering and the hide were recovered to give an accurate idea of the appearance of the animal. The remains of food were found between the teeth, on the tongue, and in the stomach. It is probable that, while feeding, the animal slipped into an ice crevasse, where its body became covered with a mass of sand and clay, and was permanently preserved by freezing.

Dr. R. Pohle, in February, spoke before the Geographical Union

of Dresden on the question whether the numerous mammoths that had been found had lived in north Siberia, where their remains have been discovered, or whether their bodies were carried there by floods in the rivers (*Verhandlungen* of the Berlin Geog. Soc., 1901, Nos. 8 and 9). He said that all the evidence of the last century showed that they had lived where their remains were found. A sub-cutaneous layer of fat and a thick wool-covering adapted them for a cool climate; and during their geological epoch conifers, birch, alders, and willows grew to the shores of the ice sea and on the New Siberian Islands, the animals feeding on their leaves and branches. They were gradually destroyed by the increasing cold, which drove the tree boundary southward.

ECONOMIC GEOGRAPHY.

DISTRIBUTION OF THE MANUFACTURING INDUSTRIES OF THE UNITED STATES.—This table is compiled from the Census *Bulletin* on Manufactures in the United States. It shows the gross value in million dollars of the products of the manufacturing industries of the United States, in 1900, by States and Territories, arranged in the order of their productivity:

1. New York, 2,175.
2. Pennsylvania, 1,835.
3. Illinois, 1,266.
4. Massachusetts, 1,035.
5. Ohio, 832.
6. New Jersey, 611.
7. Missouri, 385.
8. Indiana, 378.
9. Wisconsin, 361.
10. Michigan, 357.
11. Connecticut, 353.
12. California, 303.
13. Minnesota, 263.
14. Maryland, 243.
15. Rhode Island, 184.
16. Kansas, 172.
17. Iowa, 165.
18. Kentucky, 155.
19. Nebraska, 144.
20. Virginia, 133.
21. Maine, 127.
22. Louisiana, 121.
23. Texas, 119.
24. New Hampshire, 118.6.
25. Tennessee, 107.
26. Georgia, 106.6.
27. Colorado, 103.
28. North Carolina, 95.
29. Washington, 87.
30. Alabama, 81.
31. West Virginia, 75.
32. South Carolina, 59.
33. Vermont, 58.
34. Montana, 57.
35. District of Columbia, 48.
36. Oregon, 46.
37. Delaware, 45.3.
38. Arkansas, 45.2.
39. Mississippi, 40.
40. Florida, 37.
41. Hawaii, 25.
42. Arizona, 21.3.
43. Utah, 21.2.
44. South Dakota, 12.
45. North Dakota, 9.
46. Oklahoma, 7.
47. New Mexico, 5.6.
48. Wyoming, 4.3.
49. Alaska, 4.2.
50. Idaho, 4.
51. Indian Ter., 3.8.
52. Nevada, 1.6.

COTTON-GROWING IN TOGO.—In 1900 the German Colonial Industrial Committee secured the services of some young negro farmers from Booker Washington's school to go to Togo, the German colony on the Gulf of Guinea, West Africa, to experiment with cotton-growing. It was hoped, if the results were promising, to make cotton culture one of the native industries, and provide Ger-

many with a colonial source of cotton supply. The results of the experiment thus far are published in No. 2 of the Committee's *Beihefte zum Tropenpflanzer* (1902). The experiment has been carried out at seven places in Togo with gratifying results. Soil and climate are alike favourable to the growth of cotton, and the natives readily understand the American method of cultivating it.

The area adapted for cotton culture is about 500,000 hectares in extent, or larger than the entire cotton-growing region of Egypt. The first shipment, about 8,400 pounds of lint cotton, reached Bremen on February 5 last, where it was graded as a little superior to American middling. The Committee believes that a gradual but steady development of the industry among the natives may be expected, and that the prospects will be improved when the railroad between the port of Lome and the interior, now building, affords cheaper transportation (*Globus*, 1902, April 24).

M. FROIDEVAUX'S PARIS LETTER.

PARIS, May 20, 1902.

Side by side with the Service Géographique de l'Armée, of which I have written in the BULLETIN, is the Service Hydrographique de la Marine, which holds, with regard to nautical geography, a position deserving of no less careful study than that accorded to the important geographical institution under the Ministry of War.

It was on the 19th of November, 1720, that Louis XV created the Depository of Marine Charts and Plans, the germ of which seems to have been a special establishment, as yet very little known. In the last thirty years of the XVIIth century Colbert and Seignelay required the Royal engineers to survey the coasts of France, and occasionally foreign coasts. From this period date the first trustworthy marine charts and the labours, the results of which are given in the *Neptune François*, published in 1693, and it was then that there were brought together in Paris the documents which constituted in 1720 the first series of the Depository of Charts and Plans, Journals, and Memoirs relating to navigation. This establishment, the oldest of the kind, antedating those of England and the United Provinces by nearly twenty years, was under the charge of the Chevalier de Luynes, who was succeeded by a number of general officers, including the illustrious Marquis de La Galissonnière; but the soul of the new establishment was Jacques Nicolas Bellin, who entered it in 1721, formed its collections, and drew its first charts. These bear the date of 1737, and represent, therefore, the obscure labour of sixteen years. Compiled as they were from the most diverse elements, the maps were superior to those which had previously appeared. The chart of the Mediterranean in three sheets amply proved the utility of the new institution, and Bellin obtained in 1741 the title of Hydrographic Engineer of the King. From that time the charts were engraved at his expense and sold for his account. Engineers directed and controlled by him designed nautical charts from materials furnished by log books and the observations of seamen, and these became the *Hydrographie Française*.

Bellin died in 1772, and his establishment underwent a temporary eclipse. It revived, however, and its organization remained the same until the Revolution. The charts and plans were constructed more scientifically and with greater care, but the engineers gathered their material from the institution itself, and took part in actual survey only on rare occasions.

A change was made after the 29th of Thermidor, An III (July 16, 1795), when Beautemps-Beaupré became Director. Under him was constituted the corps of Marine Hydrographic Engineers, which was definitively organized in 1814, and was actively engaged in every department of the service by the year 1816. Reconnaissances had already been made under Napoleon on the coasts of the English Channel, the Atlantic, and the Adriatic. With 1816 began the regular survey of the western coast of France, terminated in 1838; then followed the Mediterranean coast (1839–1844), and the Italian (1845–1847). Reconnaissances were pursued at the same time in Corsica, Sardinia, Algeria, Senegal, Brazil, and Martinique, and voyages of circumnavigation and discovery (*La Coquille*, *la Vénus*, *la Bonite*, *l'Astrolabe*, *la Zélée*, *etc.*) were made to the most distant seas. It is the period of great scientific activity in the Dépôt des Cartes et Plans, and this activity was maintained in the second half of the XIXth century. There were no expeditions like those of Duperrey, Dumont d'Urville, and others, but hydrographic surveys were continued in all directions; in Italy to the Strait of Messina, in Spain, Morocco, in the Strait of Gibraltar, in Algeria and Tunisia, in Madagascar, Cochin China and Tonkin, in Japan, in New Caledonia, in Brazil, Guadeloupe, and Newfoundland. The Corsican coast survey has been completed, and the work done on the coasts of France has been subjected to an uninterrupted systematic revision, since the year 1865.

Something must be said of two Congresses held since my last communication. One, the National Congress of French Geographical Societies, met for its 23d session at Oran, in the first week of April, under the presidency of M. Gabriel Hanotaux, of the French Academy. At the same time the City of Oran was celebrating the 1,000th anniversary of its foundation. Some of the communications brought before the Congress were of a kind too often made at such gatherings; others possessed a genuine value. Among these were a paper by M. Augustin Bernard on the natural characteristics of the Oran territory, and one by M. Bel on the *chotts** and the *sebkhas** of Algeria; besides a study of the ports in Oran by M. Bernard, and M. Miramont's paper on the free markets in southern Oran. An interesting discussion on the subject of assimilating the native populations brought out the expression of opinions formed from a rigorous comparison of facts. Two excellent papers on Morocco must be noted—that by the Comte de

* *Chott*, a salt lake which dries up in summer; *sebkha*, a salt lagoon, a lacustrine depression.

Castries on the present state of our geographical and historical knowledge of the country, and that of M. de Ségonzac, showing the results of his journeys in the least-known parts of the Empire, and illustrated by his maps and photographs. It is to be regretted that nothing was heard from MM. E. Doutté and G. B. M. Flamand; but the Congress was successful, and the excursions which followed added to its interest. These excursions were to Tlemcen and the west of the Oran territory, on the one hand, and on the other across the Tell and the High Plateaux to the southern slope of the Saharan Atlas as far as Aïn Sefra and Duveyrier, from which point the tourists commanded the stony Hammada stretching away to the horizon, and toward the southwest the palm-groves of Figuig.

In the same week of April the Congress of Learned Societies was held in Paris. At this, papers were read on physical geography, the history of geography, and historical geography, and even on Americanism, Dr. E. T. Hamy having submitted an interesting archæological map of the Orinoco; while M. Lejeal, professor at the College of Melun, described the excavations of Mr. Saville at Mitla. These papers, together with those of MM. A. Pawlowski and Saint-Jours on the alterations of the French shore in the regions of Arvert and Vaux and in Gascony, and of M. Fabre on the evolution of the forms of the terrain in Lower Gascony, will no doubt be published in the *Bulletin de Géographie Historique et Descriptive*. M. Charles Rabot and M. Vidal de la Blache spoke on the subject of glaciers, and M. Rabot described the ancient roads across the mountainous regions of France; M. Chantre laid before the Section an archæological map of the Department of Saône-et-Loire; and other communications deserve particular mention. Among these was a study by M. Gabriel Marcel of a map of Picardy by Truchet (XVIth century), a paper by M. Saint Yves on the first accounts of the French and English Antilles, one by M. J. de Dampierre on the first historians of the French Antilles (and particularly on Father du Tertre and his original texts), and one by M. Pelletier on an Episode of the French explorations in North America for the discovery of the sea in the west. This last paper is to appear in the *Bulletin* published by the Committee.

At meetings of the Section of Science, in the same Congress, MM. E. A. Martel and Armand Viré spoke on the geological and biological study of caves, M. Ferrasse presented a study of the Causse Minervois (Department of Hérault), and M. Belloc treated the subject of the lacustrine dams and the lake reservoirs of the Pyrenees.

Mention must also be made of Dr. Magnin's notes on his new researches concerning the vegetation of the 68 lakes in the Jura; of those of M. Malinvauld on the flora of the Lot Department, and of M. A. Lacroix's study of the mineralogy of Madagascar, its rocks and stones and its precious metals.

These are the principal recent manifestations of geographical activity to be noted here; but we must not overlook the communications made to the Société de Géographie by travellers whose reports have not yet been published. M. Edmond Doutté, author of a valuable Journey in Morocco, after tracing the road from Marrakesh to the Upper Atlas, the aspect of the mountains and the gorges that lead to the valley of Gountafi, described the present condition of Tin Mêl, the ancient capital of the Almohade dynasty, the ruins of which he discovered in the heart of the Atlas and photographed. He furnished also valuable details on the Berbers of Morocco, the *Chleuh*, whom he visited, and the *Berâber*, lately studied by M. de Ségonzac; he showed that the populations of Grande-Kabylie, in Algeria, present a more ancient and less Islamitic type, that all these Berbers of Morocco, though strongly resembling each other and resembling those of Algeria, form populations without cohesion, from a social point of view. Only one bond holds them together, that of religion—Islam, which has assumed in North Africa, and particularly in Morocco, a special tint, and has accommodated itself to the faiths which preceded it. The ancient rites and the ancient divinities have been covered by the worship of saints—maraboutism; the marabouts have captured the living forces of society in Morocco; under the name of *Sherifs* they maintained the struggle against Spain and Portugal in the XVth and XVIth centuries, and after having saved Morocco, founded their government. This address was both archæological and ethnographic; that of M. G. Grandidier, on the southern portion of Madagascar (south of the Onilahy and west of the Mandrare), was devoted to the physical geography of a region almost unknown until explored by him in 1901. This part of Madagascar consists of a vast calcareous plateau, with a mean elevation of 120 to 150 metres (400 to 500 feet), and characterised by extreme dryness, which has wholly changed the aspect and the forms of animal life. The inhabitants, Antandroys and Mahafalys, live for several months of the year on the cactus fruit and drink the juice of the leaves, extracted by crushing. Arid and uncultivated as it is, the country is well peopled and furnishes some resources, chief among which are cattle and india rubber. Besides his observations of all kinds, M. Grandidier brought back with him notes and itineraries on a scale of

1:200,000—more especially of the route from Fort Dauphin to Tuléar, by Cape St. Mary.*

Commander Bourgeois, Chief of the Geodetic Mission to Ecuador, sends a report of the operations in 1901–1902. After transporting their material from Guayaquil to Riobamba, the party set to work and completed most of the fundamental operations—the measurements of a primary base at Riobamba; the latitude of the extremities of the arc (in the north Tulcan and Paita in the south); fundamental latitudes and longitudes at Riobamba and Quito, and a base for verification at Tulcan. Notwithstanding the obstacles due to the lack of means of communication in the mountains, the programme arranged for the year 1901 was entirely completed. There remain to be carried out the measurements of angles and the complementary astronomical measurements—the work of the next three years.

There is little to be said of explorations in progress. M. Thomann, who was charged with the duty of uniting Capt. Blondiaux's itineraries with a point on the Guinea Coast, and of ascending the course of the middle Sassandra, has succeeded in both aims. Crossing the country of the Bétés, the Baninas and the Los, he reached Séguéla and laid down definitively the course of the Sassandra, confirming in this way the views of Capt. d'Ollone as to the possibility of penetrating by peaceful measures into the hitherto inaccessible districts to the west of Bandama. A scientific party, under the leadership of M. Aug. Chevalier, already known by excellent works on Senegal and the western Sudan, has just started for the French Congo and the banks of the Shari.

M. Dessirier de Paurvel has found that the identification of the Bali with the Likuala-aux-Herbes (Likuala-Essudi?) is incorrect. The latter is a small stream, the outlet of a marsh; the Bali is identical with the Lobaï.

In Indo-China Dr. H. Reboul has carefully studied the Lang-Sa plateau.

The number of new books is never great at this season of the year. Attention may be called to the second volume of the work on the French Colonies, noticed in my last letter. This second volume treats of the French Congo, the colonies of the Indian Ocean, those of the Pacific, and of America. A number of appendices—on the French population of North America, on the aids to colonisation, on colonial bibliography—add to the value of the work.

* The *Revue de Madagascar* published in April the journal of a companion of M. Grandidier's, Sergeant Baldauf, from the lower Manambovo to Tuléar.

At the Académie des Sciences, M. A. J. Boudariet presented, in February, a geological map of Bambouk (in eastern Senegal) on a scale of 1:250,000, accompanied by a study of the structure of the country, of which very little was previously known, although it was recognized as a gold-bearing region in the XVIII century.

In M. Gentil's book, *La Chute de l'Empire de Rabah*, will be found a very soberly-written account of the interesting events which preceded and prepared the overthrow of the Rabist power. There are valuable appendices on the missions of Béhagle and Bretonnet, as well as on the geographical results obtained by M. Gentil and his fellow-workers. Something must be said of the paper published by M. G. Saint Yves in the *Annales de Géographie* under the title of *À travers l'Érythrée italienne*. It excellently characterises the three bordering regions—Erythraean, Abyssinian, and Nilotic.

In a volume entitled *Madagascar au Début du XX^e^ Siècle* are brought together the lectures delivered at the Muséum d'Histoire Naturelle, in 1901, by Dr. Raphael Blanchard and his scientific collaborators. The work is admirably illustrated, and is dedicated to M. Alfred Grandidier, "whose memorable explorations prepared the conquest of the great African island."

Another timely work is the report of M. Paul Doumer, Governor-General of French Indo-China, on the *Situation de l'Indo-Chine* (1897–1901). It is full of figures and of facts of great interest, and is accompanied by a map on a scale of 1:3,000,000 by the Geographical Service of Indo-China.

M. Henri Vignaud's important work on Toscanelli's letter and map continues to attract the attention of historians. Some admit the author's theories, at least in general; others absolutely reject them. Of these is M. Lucien Gallois, who, in an article in the *Annales de Géographie*, positively refuses to accept M. Vignaud's thesis, and adheres to the opinion currently received down to the year 1900. M. Gabriel Marcel is much less confident of the correctness of the ancient theories. His excellent study in *La Géographie*, of April, does full justice to the importance of M. Vignaud's work, and recognises that from his labours and those (still unpublished) of M. Gonzalez de la Rosa there will at last come forth the truth concerning Columbus, "already seriously damaged by previous publications," and concerning the history of the discovery of America.

HENRI FROIDEVAUX.

U. S. BOARD ON GEOGRAPHIC NAMES.

DECISIONS

JUNE 4 AND 5, 1902.

BARNETT; run, near Bridgeport, Harrison Co., W. Va. (Not Barnet.)

BENTONS FERRY; P. O. and R.R. station, Marion Co., W.Va. (Not Benton Ferry.)

BONAIRE; island, one of the Dutch West India islands, in the Caribbean sea, off the coast of Venezuela. (Not Buen Ayre.)

NOTE.—This is a reversal of the decision Buen Ayre made in 1891.

COBUN; creek, in Monongahela Co., W. Va. (Not Coburns.)

CONNORVILLE; P. O. and R. R. station, Jefferson Co., Ohio. (Not Connor nor Connorsville.)

DAVISSON; run, branch of West Fork river, Harrison Co., W. Va. (Not Davidson's.)

DAVISSON; run, branch of Simpson creek, Harrison Co., W. Va. (Not Davidsons.)

FASSETT; point, Sinepuxent bay, Worcester Co., Md. (Not Fassetts nor Henry.)

FUDGES; creek and P. O., Cabell Co., W. Va. (Not Fudger.)

GIBSON CITY; P. O. and R. R. station, Ford Co., Ills. (Not Gibson.)

GLENNS; run, Ohio Co., W. Va. (Not Glen's.)

GLENNS RUN; R. R. station, Ohio Co., W. Va. (Not Glens Run.)

GREEN VILLAGE; P. O. and R. R. station, Franklin Co., Pa. (Not Greenvillage.)

HORRELL; precinct, Frontier Co., Neb. (Not Howell.)

HUPA; Indian tribe, mountain and P.O., Humboldt Co., Cal. (Not Hoopa, Hoopah, Ho-pah, Hupâ, Húpô, Noh-tın-oah, nor Up-pa.)

HUPA VALLEY; Indian agency and reservation, Humboldt Co., Cal. (Not Hoopa Valley.)

INNER MANCHAS; coral reef or bank on north side of entrance to Mayaguez Bay, Porto Rico, W. I. (Not Inner Machos, etc.)

JAFFREY; point, the southern point of entrance to Portsmouth harbor, N. H. (Not Jaffray nor Jerry's.)

NOTE.—This is a reversal of the decision Jaffray made March 7, 1900.

KENNEATTO; creek, Fulton and Saratoga Cos., N. Y. (Not Fonda nor Kennyetto, etc.)

LEHI; P. O. and R. R. station, Utah Co., Utah. (Not Lehi City)

MACHOS GRANDES; coral reef or bank, on south side of entrance to Mayaguez Bay, Porto Rico, W. I. (Not Allart, Great Manchas, nor Machos.)

MANCHAS; coral reef or bank, on north side of entrance to Mayaguez Bay, Porto Rico, W. I. (Not Machos Grandes.)

MANCHAS CHICAS; coral reef or bank, on north side of entrance to Mayaguez Bay, Porto Rico, W. I. (Not Machos Chicos.)

OUTER MANCHAS; coral reef or bank, on northern side of entrance to Mayaguez Bay, Porto Rico, W. I. (Not Outer Machos.)

PERELESHIN; mountain, east of the Stikine river and near the Alaska-Canada boundary line. (Not Pereleshini.)

PROVO; P. O. and R. R. station, Utah Co., Utah. (Not Provó City.)

RAQUETTE; lake, Hamilton Co., N. Y. (Not Racket.)

RAQUETTE; pond, Franklin Co., N. Y. (Not Racket.)

RAQUETTE; river, of northern N. Y., draining lake and pond of same name, and emptying into the St. Lawrence river. (Not Racket.)

RAQUETTE LAKE; P. O. and R. R. station, Hamilton Co., N. Y. (Not Racket Lake.)

SEA GULL; six rocky islets between Unalga and Akutan, in Akutan pass, eastern Aleutians, Alaska. (Not Baby nor Gull.)

SOUTHMAYD; P. O. and R. R. station, Grayson Co., Texas. (Not Southmayde.)

STEEL; mountain in the Olympic group, Jefferson Co., Wash. (Not Steele nor Stone.)

VALDES; glacier, narrows, port, summit and town, Prince William Sound, Alaska. (Not Valdez.)

VAN ETTEN; P. O., R. R. station, township and village, Chemung Co., N. Y. (Not Vanetten.)

WEST FORK; river, in Marion, Harrison, and Lewis Counties, W. Va. (Not West Fork Monongahela.)

WHEELING; creek, Ohio and Marshall Counties, W. Va. (Not Big Wheeling.)

WHEELING; island, in Ohio River at Wheeling, W. Va. (Not Madison nor Zanes.)

WILLOW ISLAND; R. R. station, Dawson Co., Neb. (Not Willow.)

ACCESSIONS TO THE LIBRARY.

MAY–JUNE, 1902.

BY PURCHASE.

Almanaque Imperial para el año de 1866. Mexico, J. M. Lara, 1866. 8vo.

BEAL, SAMUEL (*Translator*).—Travels of Fah-Hian and Sung-Yun, Buddhist Pilgrims from China to India. London, Trübner & Co., 1869. 8vo.

BELL, EUPHEMIA YOUNG.—Beautiful Bermuda. New York and Bermuda, J. D. & F. R. Bell, 1902. 12mo.

BELLET, ADOLPHE.—La Grande Pêche de la Morue à Terre Neuve. 2e Éd. Paris, Augustin Challamel, 1902. 8vo.

BOLTON, ROBERT.—History of the several Towns, Manors and Patents of the County of Westchester, &c. Revised edition. New York, Chas. F. Roper, 1881. 2 vols. 8vo.

BURDETT, EVERETT W.—History of the Old South Meeting-House. Boston, B. B. Russell, 1877. 8vo.

CARDENAS Y CANO, GABRIEL DE.—Ensayo Cronologico para la Historia General de la Florida. Madrid, Oficina Real, 1723. Folio.

CHEYNE, T. K., AND BLACK, J. SUTHERLAND (*Editors*).—Encyclopædia Biblica, Vol. III, L to P. New York, The Macmillan Co., 1902. 8vo.

DAVIES, N. DE G.—The Rock Tombs of Sheikh Saïd. *Archæological Survey of Egypt, 10th Memoir*. London, Egypt Exploration Fund (1902). 4to.

DES BARRES, J. F. W.—Nautical Remarks and Observations on the Coasts and Harbours of Nova Scotia. (London, published by the Admiralty,) 1778. Oblong 4to.

DIGBY, WILLIAM.—"Prosperous" British India. London, T. Fisher Unwin, 1901. 8vo.

FIELD, BARRON (*Editor*).—Geographical Memoirs on New South Wales. By Various Hands. London, John Murray, 1825. 8vo.

FLORES, HENRIQUE.—Memorias de las Reynas Catholicas. Segunda Edicion. Madrid, Antonio Marin, 1770. 2 tomos 4to.

FOSTER, WILLIAM (*Editor*).—Letters received by the East India Company from its Servants in the East. Vol. VI, 1617. London, Sampson, Low, Marston & Co., 1902. 8vo.

GARCILASSO DE LA VEGA.—Primera Parte de los Commentarios Reales que tratan del origen de los Yncas, &c. En Lisboa, Pedro Crasbeeck, 1609. Folio.

GARCILASSO DE LA VEGA.—Historia General del Peru, &c. En Cordova, Viuda de Andres Barrera, 1617. Folio.

GENTIL, EMILE.—La Chute de l'Empire de Rabah. Paris, Hachette et Cie (1902). 8vo.

Geographisches Jahrbuch, Band XXIV, 2te Hälfte, 1902. Gotha, Justus Perthes, 1902. 8vo.

GOODISSON, WILLIAM.—Historical and Topographical Essay upon Corfú, Leucadia, &c. London, T. & G. Underwood, 1822. 8vo.

HOSMER, JAMES K.—History of the Louisiana Purchase. New York, D. Appleton & Co., 1902. 16mo.

INGLEFIELD, E. A.—A Summer Search for Sir John Franklin. London, Thos. Harrison, 1853. 8vo.

International Year-Book, 1901. New York, Dodd, Mead & Co. (1902). 8vo.

LANMAN, CHARLES.—Farthest North; or, Life and Explorations of Lieut. J. B. Lockwood. New York, D. Appleton & Co., 1885. 12mo.

LE PLONGEON, ALICE DIXON.—Queen Moo's Talisman. New York, Peter Eckler (1902). 8vo.

MARX, ROGER.—Les Médailleurs Modernes à l'Exposition Universelle de 1900. Paris, H. Laurens, 1901. Folio.

MURILLO Y VELARDE, TOMAS DE.—Tratado de Raras y Peregrinas Yervas. Madrid, Francisco Sanz, 1674. 4to.

NAOROJI, DADABHAI.—Poverty and Un-British Rule in India. London, Swan, Sonnenschein & Co., 1901. 8vo.

NAVILLE, EDOUARD.—Temple of Deir El Bahari, Part IV. London, Egypt Exploration Fund (1902). 4to.

NEWTON, ALFRED, AND GADOW, HANS. A Dictionary of Birds. London, Adam and Charles Black, 1893–96. 8vo.

PAOLINO DA SAN BARTOLOMEO: Voyage to the East Indies. London, Vernor & Hood, 1800. 8vo.

P(AUW), MR. DE.—Recherches Philosophiques sur les Egyptiens et les Chinois, Amsterdam et Leyde, Barth. Vlam, 1773. 2 tomes. 12mo.

PEARSON, HENRY J.—"Beyond Petsora Eastward." London, R. H. Porter, 1899. 8vo.

PEEL, C. V. A.—Somaliland. London, F. E. Robinson, 1900. 8vo.

PETERS, DE WITT C.—Life and Adventures of Kit Carson. New York, W. R. C. Clark & Meeker, 1859. 8vo.

PIOLET, J. B.—Les Missions Catholiques Françaises au XIX^{e} Siècle. Tome IV, Océanie-Madagascar. Paris, A Colin & Cie., 1902. 8vo.

PULGAR, HERNANDO DEL.—Crónica de los Señores Reyes Católicos Don Fernando y Doña Isabel, &c. Valencia, Benito Monfort, 1780. Folio.

Relation Nouvelle d'un Voyage de Constantinople. Paris, Pierre Rocolet, 1680. 4to.

REYNOLDS, CHARLES B.—Old Saint Augustine. 5th Edition. St. Augustine, E. H. Reynolds, 1891. 16mo.

ROSCOE, THOMAS.—Wanderings and Excursions in North Wales. London, H. G. Bohn, 1853. 8vo.

SANSON, NIC.—Geographia Sacra ex Veteri et Novo Testamento Desumta, &c. Amstelædami, Franciscus Halma, 1704. Folio.

S. PAOLO, CAROLUS À.—Notitia Antiqua Dioecesium Omnium Patriarchalium, Metropoliticarum, et Episcopalium Veteris Ecclesiæ, &c. Amstelædami, Franciscus Halma, 1704. Folio.

SCROFANI, XAVIER.—Voyage en Grèce, 1794 et 1795. Paris et Strasbourg, Treuttel et Würtz, An IX, 1801. 3 tomes, 8vo.

SWINBURNE, HENRI.—Voyage de . . . dans les Deux Siciles, en 1777–1780. Paris, Didot l'Aîné, 1785–1787. 5 tomes. 8vo.

SWINBURNE, HENRI.—Voyage de . . . en Espagne, en 1775 et 1776. Paris, Didot l'Aîné, 1787. 8vo.

SYKES, PERCY MOLESWORTH.—Ten Thousand Miles in Persia. London, John Murray, 1902. 8vo.

BY GIFT.

From D. Appleton & Co., Publishers, New York:

An Introduction to Physical Geography. By Grove Karl Gilbert and Albert Perry Brigham. New York, 1902. 8vo.

From Edwin Swift Balch, Author, Philadelphia:

Antarctica. Philadelphia, Allen, Lane & Scott, 1902. 8vo.

From Oliver G. Barton, New York:

Carte Pittoresque et Maritime de l'Europe, A. M. Perrot (et A. Vuillemin), Paris, Fatout, 1857, sheet, mounted; Paris Nouveau et Ses Environs d'après les Photographies, Paris, Lédot Frères, 1857, oblong folio.

From W. J. Bormay, New York:

Map of the World on an Equivalent Projection. Boston and New York, J. L. Hammett Co. (1902). Sheet, on rollers, 64¼ x 41½ in.

From Dr. Renward Brandstetter, Author, Lucerne:

Tagalen und Madagassen. Luzern, Buchhandlung Geschw. Doleschal, 1902. 8vo.

From Silas Farmer, Detroit:

Sectional Map of the State of Michigan, Detroit, S. Farmer & Co., 1901, sheet, 38 x 34¾ in., folded in cover; Michigan Book, a State Cyclopædia, Detroit, S. Farmer & Co. (1901), 12mo.

From Dr. H. Fritsche, Author, St. Petersburg:

Die Tägliche Periode der Erdmagnetischen Elemente. St. Petersburg, 1902. 8vo.

From Alexander Kalecsinsky, Author, Budapest:

Über die Ungarischen Warmen und Heissen Kochsalzseen als Natürliche Wärmeaccumulatoren, u. s. w. Budapest, 1901. 4to.

From Colonel Richard Lathers, New York:

Biographical Sketch of Colonel Richard Lathers. Philadelphia, J. B. Lippincott Co., 1902. 8vo.

From Jules Leclerc, Author, Brussels:

La Carrière Coloniale de Cecil Rhodes. (Extrait de La Revue Générale, Mai, 1902.) Bruxelles, 1902. p., 8vo.

From Albert Matthews, Author, Boston:

The Term Indian Summer. (Reprinted from the Monthly Weather Review for Jan. and Feb., 1902.) p., 8vo.

From N. F. Morrison, Newark:

Journal of a Voyage from Charleston to the East Indies: March 17 to Oct. 17, 1796. MS., folio.

From Paul F. Mottelay, New York:

Two maps: 1. Das Planeten System der Sonne, zuerst von Copernicus 1543 aufgestellt, u. s. w., von C. F. Weiland, Weimar, 1831, 24⅝ x 21⅝ in.; 2. Die Gestirne

in zwei nach dem Aequator abgetheilten Planisphaeren, u. s. w., von F. G. Haan, Doctor Prof., Leipzig, J. C. Hinrichs, 1827. *2 sheets* · Nördliche Halbkugel, 24¼ x 26¾ in.; Südliche Halbkugel, 24¼ x 27 in.

From Dr. Fridtjof Nansen, Christiania :

On a New Current-Meter invented by Prof. Fridtjof Nansen, by V. Walfrid Ekman (Reprint, 1901), p., 8vo; On the Use of the Hydrometer of Total Immersion, by Jakob Schetelig (Reprint, 1901), p., 8vo; Some Oceanographical Results of the Expedition with the "Michael Sars," headed by Dr. J. Hjort in the summer of 1900; Preliminary Report by Fridtjof Nansen, Christiania, A. W. Brogger, 1901, p., 8vo.

From the Council of the Fridtjof Nansen Fund, Christiania :

The Norwegian North Polar Expedition, 1893–1896: Scientific Results, Vol. III, Christiania, Jacob Dybwad; London, *et al.*, 1902. 4to.

From the Department of the Interior, Ottawa, Canada :

General Map of the Northwest Territories and of the Province of Manitoba, Revised and corrected to August, 1894, Ottawa, 3 sheets, 37½ x 25 in.; Atlas of Western Canada, Census edition, 1901, Ottawa, 1902, p., 4to; Index showing the Townships in Manitoba, the N. W. Territories, etc., plans of which have been printed up to the 1st of January, 1902, sheet, 27½ x 14½ in.; Synopsis of Regulations governing Timber, Grazing, etc., on Dominion Lands in Manitoba, etc., etc. (Ottawa, 16th Jan., 1902), p., 8vo; Synopsis of Regulations for Disposal of Minerals on Dominion Lands in Manitoba, etc., s. l., s. a., p., 8vo; Mennonites in Manitoba, 1875–1900, by J. F. Galbraith, Morden, Manitoba, 1900, p., 8vo; British Columbia, 1900 (with map), s. l., s. a., p., 8vo; Prosperity follows Settlement in Western Canada, Ottawa, 1902, p., 8vo; Guide to Homesteaders in Manitoba and the Territories of Western Canada, Ottawa, 1900, p., 8vo; Free Homesteads in New Ontario, Canada (map of the Region); The District of Saskatchewan, Western Canada: Free Farms, etc., 1901 (map of the Region).

From Miss Luella Agnes Owen, St. Joseph, Missouri :

A Memorial to the Nations of the Air. By Juliette A. Owen. *Publication of the Audubon Society of Missouri*, St. Joseph, Mo. (1902). p., 12mo.

From Hon. T. C. Platt, Washington :

Report of the Isthmian Canal Commission, 1899–1901. Washington, 1902. 8vo.

From Henry William Rankin, Author, Madison, N. J.:

Divie Bethune McCartee, M.D., Pioneer Missionary. A Sketch of his Career. In the Evangelist and Religious Review, May 22, 1902. pp. 604–607.

From Dr. Sophus Ruge, Author, Dresden :

Columbus. 2te Auflage, mit 3 Bildnissen und 2 Karten. Berlin, Ernst Hofman & Co., 1902. 8vo.

From P. Fernando Sanjinés, La Paz, Bolivia :

Academia Aymara (Revista mensual), Año I, Nos. 1–3, Oct., 1901–Abril, 1902. La Paz.

From Henri de Sarrauton, Oran, Algeria :

Extrait des Comptes-Rendus de l'Académie des Sciences du 17 Janvier, 1898, sur le Système de l'Heure Décimale, etc. (Reprint, 1902.)

From Charles Howard Shinn, Author, Berkeley, Cal.:

A Study of San Luis Obispo County, California, *Reprinted from Sunset Magazine, September, 1901*, p., 8vo; Comments on Recent Outdoor Literature, English

and American, *Reprint from the Overland Monthly for Feb. and March, 1902*, San Francisco. p., 8vo.

From the Library of Congress, Washington:

A List of the Maps of America in the Library of Congress. By P. Lee Phillips, Washington, Government Printing Office, 1901. 8vo.

From W. Willcocks, C.M.G., etc., Author, Cairo:

Egypt Fifty Years Hence. An Address delivered at a Meeting of the Khédivial Geographical Society, Cairo, March 15, 1902. Cairo, National Printing Dep't., 1902. p., 8vo.

From Gen. James Grant Wilson, New York:

A New System of Modern Geography. By William Guthrie. 1st American Edition. Philadelphia, Matthew Carey, 1794. 2 vols. 4to.

DEPARTURE OF THE "WINDWARD."

The Peary Arctic steamer *Windward* will go into commission July 7 for the expedition of 1902 at her pier near the Erie station in Jersey City, and by dawn next day will be under way *via* Long Island Sound for the Far North. The *Windward* will come down under her own steam from Newburgh, N. Y., where for the last two months she has been receiving new equipment of boilers and machinery. The ceremony of transfer from the contractor to the Club will be very simple. The stars and stripes having been displayed for the first time at the peak, under the special act of Congress signed by the late President McKinley, allowing an American registry to the *Windward*, little Marie Peary, daughter of the explorer, and the most northern-born child in the world, will hoist to the foretruck the Club pennant, designed by herself, and also displayed for the first time. The emblem is simple, yet effective and appropriate, with two long, narrow red stripes, each bordered on the inside by white; a triangular blue field bears the white initials "P. A. C.," the combination introducing the national colours in strong yet legible combination, which can be read a long distance. The *Windward*, since her arrival in New York three months ago, has been completely changed, and will go north as a full-powered, completely-equipped, and thoroughly-commodious ship for Arctic work. To admit the new and powerful boiler, once in the *Vigilancia*, wrecked on the Cuban coast, the mainmast has been completely removed, giving the ship the nondescript rig of square sails on the foremast and a fore-and-aft spanker and topsail on the mizzen. Across the deck just forward of the poop has been built a house which has five commodious staterooms, three of which on the starboard side will be occupied by Mr. and Mrs. Peary. In the centre of the house is a large messroom or saloon, with the cook and his galley adjoining on the port side, while the roof of the house serves as a bridge for the navigating officer. The new engine is a "steeple compound," all parts being made exceptionally strong for work in the ice, with every modern improvement, and is expected to give a speed of from seven to eight knots, equal to that of the fastest of the Newfoundland sealing fleet, and nearly three times that possible with the discarded boiler and engine. The *Windward* will coal at Sydney, C. B., and proceed north through

the Straits of Belle Isle, touching at Godhavn, and possibly at Upernavik, and should, with all favourable circumstances, reach Peary's headquarters and him about August 1.

The members of the Peary Arctic Club and many guests have visited the *Windward*, inspecting with much interest the quarters which Mrs. Peary and Miss Peary will occupy on their northern voyage, and much more, the little cabin, in which they spent eight long months, imprisoned in the ice at Payer Harbour. The little stateroom was also the home of Lieut. Peary, Jackson, and Lieut. Armitage, much smaller than the ordinary stateroom of an ocean liner. It was also the home of Mr. Jackson on his voyage to and from Franz Josef Land, and in it Dr. Nansen made his return from his arduous and adventurous Arctic voyage. While the *Windward* cabin is cramped, almost of diminutive proportions, a semi-circular table in front of a transom of cushion, it will accommodate by careful packing half-a-dozen people, but, of course, those on the inside are unable to move until those nearer the ends of the semi-circle make room for them. Four people will fill the cabin, while six crowd uncomfortably.

The little ship takes, besides the customary stores and supplies, a large amount of material for the Eskimos, presents from Mr. Peary in recognition of their faithful work, and scientific instruments with which to carry on deep sea work, and, in many respects, is better appointed and more completely equipped than any ship which has ever gone to the North.

The *Windward*, a 320-ton barque, is the most interesting and historic of all the Arctic craft now afloat. Built at Sunderland, England, in 1865, it was for more than a quarter of a century employed in the Dundee and Peterhead whale fisheries. Purchased in 1894 by Alfred C. Harmsworth, she took the Jackson-Harmsworth Expedition to Franz Josef Land, being imprisoned in the ice near Cape Flora for the winter.

The *Windward*, commanded by Capt. John Bartlett, sailed from New York for the North July 3, 1898; parted company with her consort, the *Hope*, Capt. Samuel W. Bartlett, for Etah, North Greenland, August 12, and spent the following winter fast in the ice of Allman Bay, breaking out early in August, 1899, and joining the *Diana*, the auxiliary ship, at Etah, August 12, and returning to Brigus, N. F. Extensive repairs were made to the hull and machinery early in the spring of 1900; and July 20, commanded by Capt. Samuel W. Bartlett, the *Windward* sailed from Sydney, with Mrs. Peary and her daughter on board, for the North, and, except a report from

Godhavn, August 15, nothing further was heard from her until the arrival of the *Erik*, the auxiliary ship of 1901, at Etah, August 4.

The *Windward* had spent the eight months, from September to July, fast in the ice of Payer Harbour, near Cape Sabine. At the end of the season the ship started on her return, practically under sail, and making no more than three knots, the utmost her engines could do. She wintered at Brigus, and arrived at New York March 26.

The departure of the *Windward* seems to be a proper occasion for a brief statement concerning the Peary Arctic Club, which has sustained Mr. Peary during the five years' expeditions, and which, when the subscriptions originally pledged had been all paid and expended, renewed its promise to support him and the work to the end. The Peary Arctic Club is made up of subscribers secured by Mr. Peary just before his departure in 1898, and was organized in January, 1899. Peary's original idea was to associate twenty-five men who would pledge to him and to each other four annual contributions of $1,000 each, thus insuring a working capital for four years of his enterprise of $100,000. His departure was, however, compelled, before the full number was secured, and the Club as organized in January, 1899, was: President, Morris K. Jesup; Vice-President, Frederick E. Hyde, M.D.; Treasurer, Henry W. Cannon; Secretary, Herbert L. Bridgman, who, with the late James M. Constable, Messrs. James J. Hill, E. C. Benedict, H. H. Benedict, H. Hayden Sands, E. W. Bliss, and the late President Charles P. Daly, of the American Geographical Society, were constituted founders. Messrs. Jesup and Hill each contributed a double portion of the capital, and have generously renewed their full proportion for the fifth and present year. Messrs. Edward G. Wyckoff and Clarence F. Wyckoff, of Ithaca, N. Y., and Grant B. Schley, of New York, have also joined the Club, and Mr. Frederick Constable, since his father's death, has completed and continued his subscription. The Club has faithfully seconded at home all of Mr. Peary's efforts in the North; has sent the *Hope* in 1898, the *Diana* in 1899, and the *Erik* in 1901, the second and last of which communicated with him, spending nearly a month at Inglefield Gulf, and brought home complete journals and records and a large amount of valuable material rescued by him from Fort Conger, and brought 250 miles over the ice to Grinnell Land. The members of the Club have the most unqualified faith in Mr. Peary's ultimate success, and have undertaken the expensive outlay on the *Windward* this year with, perhaps, more enthusiasm than anything else in its history. They recognize the fact that Mr. Peary's

ample stores and the best dog foods, his thorough familiarity with the route from his Cape Sabine headquarters to Cape Hecla, the point of departure from the North American coast for the Pole, give him great advantage, and they confidently expect the return of the ship early in September with the explorer and the news of his complete success.

HERBERT L. BRIDGMAN.

NOTES ON WORK OF THE U. S. GEOLOGICAL SURVEY.

THE TWENTY-SECOND ANNUAL REPORT of the Director of the U. S. Geological Survey for the fiscal year ending June 30, 1901, shows that, during the year which it covers, 35,123 square miles were covered by detailed topographic mapping, this area being distributed through 32 States and Territories; and that 12,407 miles of level were run and 1,338 permanent bench marks established; these bench marks being iron posts, bronze or aluminum tablets, or copper or aluminum plugs. In connection with this work primary azimuth observations were made at four triangulation stations, 37 meridian lines were established, 271 triangulation stations were occupied, and 2,088 miles of primary traverse were run. In connection with the surveys in Alaska, about 6,500 square miles were mapped topographically, thus opening up many new regions, some of which were before entirely unknown; in addition to the mapping, about 150 linear miles of stadia traverse and 274 linear miles of reconnaissance traverse were run. With reference to the surveys of the forest reserves, 23 miles boundary of the Black Hills Reserve and 109 miles of the boundary of the Bighorn Reserve were surveyed and marked. The completion of the topographic work of the year 1900–1901 makes a total, with that previously done, of 866,847 square miles of the United States which have been fully surveyed and mapped, or 29 per cent. of the entire area of the country.

For purposes of administration the territory of the country has been divided into four sections—the Atlantic section, the work of which is controlled by Mr. H. M. Wilson, geographer in charge; the central section, with Mr. John H. Renshawe, geographer in charge; the Rocky Mountain section, with Mr. E. M. Douglas, geographer in charge, and the Pacific section, under the direction of Mr. Richard U. Goode, geographer.

MR. G. L. SWENDSEN, engineer in charge of the hydrographic investigations in Utah, reports that a general conservation of the flood waters is necessary for further development of irrigation or the use of power. Measurements of the Bear River, which flows through a fertile valley in northern Utah, showed that the volume of water which flowed into Great Salt Lake in the last summer season was exceptionally low, less than one-half that of any previ-

ous record. The fact is thus established that the low water flow of this river will be insufficient for the large irrigating canals now being built to take water from it, and a number of other streams in the State reached this point some years ago.

THE NEED OF STORAGE of flood waters is felt in the valley of Carson River, in western Nevada. The soil of this valley is capable of being largely cultivated if water can be furnished, but the supply from Carson River cannot be relied upon for this purpose. This stream rises in California on the eastern slope of the Sierra Nevada Mountains, and, crossing the Nevada boundary, is lost in the great desert "sinks" of the latter State. In spring and early summer, when the river carries the melted snows of the mountain, it is of considerable size, but during the summer it sinks, and its waters are completely lost in the lower portion of its course. Preliminary investigations recently completed have demonstrated that, by the construction of five reservoirs on the tributaries and the main stream, it is possible to impound sufficient water to irrigate 120,000 acres of land now arid.

The estimated cost of this storage is less than $7 per acre which can be irrigated, or about $800,000. The market value of the land, when supplied with water without other improvements, is calculated at $25 per acre, giving an estimated valuation for the whole of $3,000,000. The tract will be capable of sustaining a population of over 30,000.

ONE OF THE FEATURES of the water supply of Texas is the occurrence of artesian springs, which flow from the foot of the escarpment which bounds the south-eastern portion of the Edwards Plateau. These waters are found in springs at Austin, in the San Marcos River at San Marcos, at San Antonio, and elsewhere. They issue from the ground in strong, gushing springs, and flow away in bold streams.

A careful study shows that their flow fluctuates between a high and low discharge. These changes bear a remarkable resemblance to the fluctuations of rainfall on the Edwards Plateau; the crest of the rainfall curve over this region being followed with great precision by the crest of the discharge curves of the springs. The Edwards Plateau is a flat, grass-covered upland, 14,000 square miles or more in extent. The rain which falls upon it sinks into the porous soil, and finds its way to the bold scarp line of the region, where it bursts out in the abundant springs.

The San Antonio River has its source in one of these springs, and between it and the wells driven to supply water to the City of San Antonio there seems to be close connection. It was recently noticed that when the wells were steadily drawn upon for twenty-four hours the water-level of the head lake of the river fell several inches, but that on shutting off the wells the lake regained its level in about one day. So intimate is the relation between the flow of the wells and that of the river that it is always possible to tell how high the water will rise in the former by observing the river's height on a gauge rod placed upon its bank.

ATTENTION IS CALLED by Mr. A. H. Brooks to the extensive water power existing in the narrow portion of Alaska extending southward along the Pacific. Juneau, Sitka, and Skagway are situated in this region, which produces gold and copper, and promises to be an important mining centre. Many of the low-grade ores found here occur in large bodies, and can be worked to advantage by making use of the water power. The topography favours the development of water power; high land and lofty mountains are in proximity to the coast, from which numerous streams, fed by an abundant rainfall, rush to the sea. In the southern part of the belt, more especially in the Ketchikan mining district, the water powers are available for the entire year, owing to the mildness of the climate; while in the Juneau district, in the northern part of the belt, they can be used for about eight months.

LIGHT HAS BEEN THROWN on the underground water resources of southeastern Virginia by a well recently constructed at Fort Monroe. The well was sunk to bed-rock "granite" 2,246 feet, but, although several water-bearing strata were penetrated, they were all found to develop flows of salt water. The results obtained from the Fort Monroe well confirm those found elsewhere in this region. Salt water only has been found in borings at Norfolk, Va., at 760 feet; at Wilmington, N. C., where bed-rock was reached; at the Chamberlain Hotel, Old Point Comfort, at 947 feet, and in several wells at Crisfield, in southern Maryland. These borings indicate that there are no prospects for usable underground waters in the region. Eastern Virginia is underlain by a succession of widely-extended sheets of sand and clays, lying in regular order on an east-sloping floor of granite or other "bed-rock." This rock disappears beneath the surface along a zone passing near Petersburg, Richmond, Fredericksburg, and Washington, and, descending at a

rate varying from 40 to 100 feet per mile, reaches a considerable depth near the ocean—2,246 feet at Fort Monroe. The sands of the overlying formations contain water which is abundant and fresh for the first 40 to 50 miles from the west, but is now known not to be available in the extreme southeast. Numerous fine-flowing wells have been obtained along the Potomac, Rappahannock, York, and James Rivers from several sand horizons, but about Old Point Comfort, and to the south and east, the upper water-bearing sands have changed into non-water-bearing clays, and the lower sands yield only salt water.

To ascertain the water resources of the country it is important to have facts concerning the quality of the water—whether fresh or saline, muddy or clear, etc. The United States Geological Survey is making systematic observations of the amount of material carried in suspension by flowing water, rendering it muddy or turbid, and with reference to the colour of the water from dissolved or suspended matter. The study of the colour and turbidity of water is of commercial importance, because clear water is frequently a necessity in manufacturing, and it should be available for municipal use. The method of investigation of these matters consists, in the main, of comparing a small amount of the water, held in a glass receptacle, with certain colour standards; and, for turbidity, of noting the depth beneath the water at which a small pin can be seen. A description of the methods can be found in Circular No. 8 of the Division of Hydrography.

The Deep-well Borings of the United States, made for water, oil, and gas, are the subject of a statistical report by N. H. Darton in the series of Water-Supply and Irrigation Papers of the United States Geological Survey. The list of deep wells is arranged by States, in alphabetical order, and appears in two pamphlets known as Water-Supply Papers Nos. 57 and 61. All wells 400 feet or over in depth are carefully listed. Depth, diameter, yield per minute, and other characteristic data are given, and many instructive details are noted indicating for what purpose the borings were originally made, the character of the product obtained, and whether the wells are in use or abandoned. References are given to the literature or other sources from which the data were obtained.

BOOK NOTICES.

Britain and the British Seas, by H. J. Mackinder, Reader in Geography in the University of Oxford. In Appleton's World Series. 8vo, 377 pp. 6 colored maps, 132 maps and diagrams.

We have other works which deal with the physical history of Britain, as those of Ramsay and Woodward on the geology, or of Geikie and Lord Avebury on the scenery, but this is, perhaps, the most compact and philosophical treatment of British geography. The subjects of the earlier chapters are: the Position of Britain, the British Seas, the Submarine Platform and the Movement of the Waters. The physiography of the land follows under several heads. While these chapters are mainly devoted to physical features, we find frequent reference to the distinctively human aspects of geography. Thus (p. 15) the isolation caused by the various marine waters of Britain has begotten the provincialism, which in turn has provided the varied initiative that gives meaning to liberty. This is a broad mode of treatment which we should expect from Mr. Mackinder.

Both structure and denudation are adequately recognized in the discussion of the land-forms. Physiographers will turn with special interest to Chapter IX, the Rivers of Britain. Here the modern principles of river adjustment are duly recognized. A comprehensive and easily-remembered system of longitudinal and transverse streams is described. Longitudinal streams run between the Pennine-Cambrian range and the Jurassic escarpment and between the Jurassic and Cretaceous lines of upland. There are three sets of transverse streams flowing southeastward, respectively from the Pennine-Cambrian heights, from the Jurassic, and from the Cretaceous escarpments. The reader who has even an elementary knowledge of English geology thus grasps at once the meaning of the English rivers, while a reader of Green's rather full account of the same streams, in his Short Geography of the British Isles, is left quite in the dark as to their origin and significance. The "water-gap" and "wind-gap," and the meaning of consequent and subsequent drainage, are well set forth, with the Thames and its branches as a type case. More brief, but resting on a rational basis still, is the explanation of the river systems of Scotland and Ireland.

Chapters X and XI give an account of British meteorology,

racial geography, historical geography; Metropolitan England and Industrial England are some of the subjects which follow. The essential physical characteristics of Britain are insularity, accessibility, diversity of the east and west, productive soil and climate, the coal, and the tidal rivers. These are the material secrets of Britain's greatness.

The division into Metropolitan or Southeastern, and Industrial or Northwestern England (Chapters XIV and XV) is of great interest. They are separated by a line drawn from the mouth of the Severn to the Wash. It is true of Metropolitan England that the roads centre upon London; that the coast line faces the continent, and that there is little coal or other source of power. The region is therefore commercial and residential. In Industrial England rich and poor are workers; there are few men of leisure; the country is newer and more democratic, and does not always follow the political or religious leadership of the metropolitan region. These are not unfamiliar facts, but they are developed sharply and in their true relation to physical history. The volume is indispensable to the student of British geography or history, as to the traveller who wishes the fullest appreciation of this small but richly significant land.

The entire series is edited by Mr. Mackinder. Among the projected volumes are: Western Europe and the Mediterranean, by Elisée Reclus; Africa, by Dr. J. S. Keltie; The Russian Empire, by Prince Kropotkin; North America, by Professor I. C. Russell; and South America, by Professor J. C. Branner.

A. P. B.

Practical Forestry. By John Gifford, Assistant Professor of Forestry in Cornell University. 12mo, 284 pp. Illustrated: D. Appleton & Co.

This volume is designed for the general reader, for beginners in the subject, and for farmers and owners of country places. It is the first attempt to gather out the simpler facts and principles that are of common interest and present them in popular form. The author has done this with a fresh and contagious enthusiasm. He has incidentally made a good book for reference and supplementary reading in physical geography. Perhaps the most hopeful aspect of such works is in the enlargement of the popular intelligence and the promotion of good legislation.

The earlier chapters define forests and forestry, and treat of the more general uses of the forest, as in relation to the making, im-

proving, and preserving of soils, to floods and winds, and to their esthetic and sanitary value. Chapter V gives a summary but interesting review of aids and barriers to forest extension. Perhaps the chapter on the Tending of Forests is the most useful of all for its practical suggestion. Here we find methods of improvement by clearing, pruning, and thinning, and of protection also against the foes of the forest. Such are: Fire, "the greatest enemy to the forest in America"; atmospheric agencies, as frosts, droughts, winds; injurious insects, grazing and browsing animals, parasitic plants, and weeds.

The treatment of forest industries and products will be especially valuable for classes in commercial geography. Forest refuse, lumber, wood pulp, maple sugar, resin and turpentine, tanning materials, etc., form the sub-topics here. A section is devoted to Federal and State reservations, and the book closes with a descriptive list of fifty important American forest trees, twenty-five conifers, and twenty-five hardwoods. There is a copious index.

A. P. B.

Antarctica. By Edwin Swift Balch, A. B. (Harvard); Member Philadelphia Bar; Appalachian Mountain Club; Franklin Institute; American Philosophical Society; Cor. Mem. Sociedad Cientifica Antonio Alzate, Mexico; Wyoming Historical and Geological Society, Wilkes-Barre; Author of "Mountain Exploration," "Glacières or Freezing Caverns," etc. Philadelphia, Press of Allen, Lane & Scott, 1902.

Mr. Balch's book is an enlargement of a paper contributed to the *Journal of the Franklin Institute*, 1901, Vols. CLI and CLII; but though it begins with the beliefs of the ancients and closes with a notice of the Swedish expedition, the author claims for his work no more than approximate accuracy. He says in the Introduction:

> It is hoped, however, that this book is a step towards clearing up the story of the Antarctic, and especially that it may incite other geographers to make further researches into the original records.

Mr. Balch adopts the name *Antarctica* to signify all the lands south of South America and Australia, and divides the region, for convenient reference, into East and West Antarctica. He very properly objects to Sir C. R. Markham's division of the Antarctic into four quadrants, each bearing an English name arbitrarily imposed, without inviting an expression of international opinion on the subject.

It must be admitted that *Antarctica* is an adjective form, and so far unsuitable as a name, and some persons may think that what was unnecessary in the Arctic may be dispensed with in the Antarctic.

Not a few of the daring navigators in the far south have left little record of their work. Of these was Captain Nathaniel B. Palmer of the sloop *Hero*, one of five vessels which left Stonington, Connecticut, in 1820, for the South Shetlands. Mr. Balch considers that the account in Fanning's *Voyages round the World* and Powell's Chart and Memoir on South Shetland "make it fairly certain":

1, That Palmer was probably the discoverer and certainly the first explorer of the lands lying south of Bransfield Strait and extending for some two hundred and fifty kilometers between 57° 50′ and 62° 20′ west longitude, that is, of the northern coasts of West Antarctica from Liège Island to Joinville Island, both inclusive;

2, that Palmer discovered the northern end of Gerlache Strait, which he recognized was a strait and not a bay, as subsequently charted;

3, that Palmer discovered the strait or bay since called Orléans Channel;

4, that Palmer recognized that these lands were perhaps a chain of islands;

5, that this coast or these islands were christened Palmer Land and that they were so first charted in England, France, and America.

Mr. Balch devotes a good deal of space, but not too much, to Wilkes's explorations and the long-continued belittling of his discoveries. These are now established beyond cavil, and it is with regret and amazement that one reads the rash and petulant expressions of unbelief which men of authority and character have not been ashamed to use with regard to Wilkes, almost to the present day.

The maps in this handsome volume are:

1. Reproduction of a portion of "Chart of South Shetland," by George Powell. (This chart, printed for R. H. Laurie, chart-seller to the Admiralty, London, 1822, was found, after a long search, at the Dépôt de la Marine, Paris.)

2. Reproduction of a portion of the charts published by Lieut. Wilkes and Sir J. C. Ross.

3. Chart of Antarctica by Edwin Swift Balch.

so
hat
the

left
B.
on,
on-
and
irly

er of
and
hern

cog-

they

, to
dis-
vith
res-
not
ent

by
ller
, at

eut.